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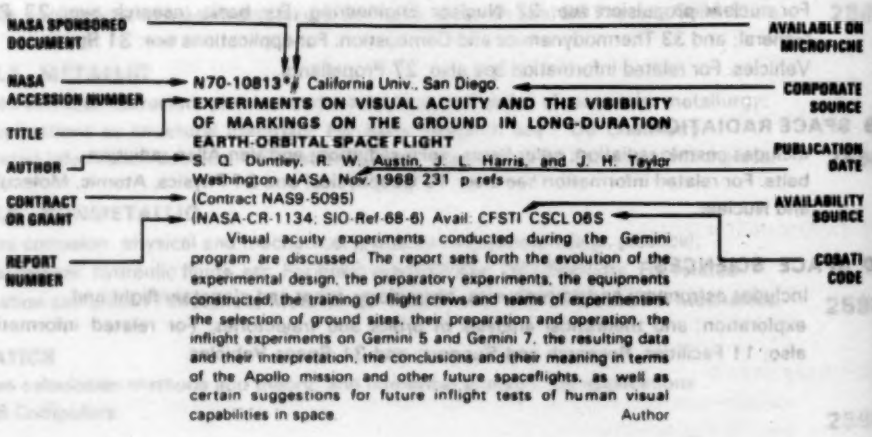
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EXPERIMENTS ON VISUAL ACUITY AND THE VISIBILITY OF MARKINGS ON THE GROUND IN LONG-DURATION EARTH-ORBITAL SPACE FLIGHT
AUTHOR
S. Q. Duntley, R. W. Austin, J. L. Harris, and J. H. Taylor
PUBLICATION DATE
Washington NASA Nov. 1968 231 p refs
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(NASA-CR-1134, SIO-Ref-68-6) Avail: CFSTI CSCL 06S
COSATI CODE
Visual acuity experiments conducted during the Gemini program are discussed. The report sets forth the evolution of the experimental design, the preparatory experiments, the equipments constructed, the training of flight crews and teams of experimenters, the selection of ground sites, their preparation and operation, the inflight experiments on Gemini 5 and Gemini 7, the resulting data and their interpretation, the conclusions and their meaning in terms of the Apollo mission and other future spaceflights, as well as certain suggestions for future inflight tests of human visual capabilities in space.
Author

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Scientific and Technical Aerospace Reports

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01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N70-27863# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.

LINEAR PROBLEMS IN THE HYDRODYNAMIC STUDY OF A WING FLYING ABOVE THE INTERFACE BETWEEN FLUIDS OF DIFFERENT DENSITIES

A. N. Panchenkov 15 Sep. 1969 25 p refs Transl. into ENGLISH from Gidrodinam. Bolshikh Skorostei (Russian), no. 1, 1965 p 7 20

(Contract NOw-62-0604-c)

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The acceleration potential method is applied to the solution of linear problems arising in incompressible flow past a wing positioned above the interface between fluids of different densities. Some general results obtained for problems involving the motion of lifting wings at high Froude numbers are discussed. Simple formulas are derived for a wing in two-dimensional flow and for a high-aspect-ratio, finite-span wing. An exact formulation of the problem is obtained for small density ratios. Author (TAB)

N70-28138# California Univ., Berkeley. Div. of Aeronautical Sciences.

THE ANALYSIS OF LAMINAR WAKES IN SUPERSONIC FLOW BY THE METHOD OF INTEGRAL RELATIONS Technical Report

James C. S. Meng Dec. 1969 88 p refs

(Grant AF-AF-AFOSR-268-67)

(AD-702146; AS-69-16) Avail: CFSTI

The singular points in the recompression region of the wake behind a hypersonic re-entry body (with a flat base) are analyzed using the method of integral relations. It is shown that the critical point just downstream of the wake reattachment point is a saddle point. Integral curves are generated connecting this point with the base flow region. All viscous effects are neglected upstream of the base shoulder; downstream of it a Chapman type solution is used to connect the integrals issuing from the saddle points. A suitable matching of flow parameters yields a unique near wake solution. Two sample cases are carried through in detail. Good agreement with experimental results is found. Author (TAB)

N70-28249# Toronto Univ. (Ontario). Inst. for Aerospace Studies.

THEORY OF AIRFOIL RESPONSE IN A GUSTY ATMOSPHERE. PART 1: AERODYNAMIC TRANSFER FUNCTION

L. T. Filotas Oct. 1969 42 p refs

(Grants AF-AFOSR-0672A-67; NRC A-2003)

(AD-700773; UTIAS-139; AFOSR-69-2150TR) Avail: CFSTI CSCL 1/3

An approximate closed form expression is derived for the loading on a two-dimensional airfoil passing through an inclined sinusoidal gust. This expression is the basic transfer function required for the construction of the response to any arbitrary localized gust or continuous turbulence by Fourier superposition. The expression, based on linearized impressible lifting surface theory, is asympototically exact in the limiting cases where the reduced frequency (which is proportional to the ratio of airfoil chord to gust wavelength) is either very large. When the gust inclination is such that the nodal lines are perpendicular to the flight path, the resulting special case is a well-known problem of unsteady airfoil theory (Sears problem). The loading obtained for this case has the form predicted by classical theory. The value for the lift, while not exactly identical to the Sears function, differs from it only slightly in the range of reduced frequency of order unity. It is demonstrated that the accuracy for the general case is of the same order. Author (TAB)

N70-28250# Toronto Univ. (Ontario). Inst. for Aerospace Studies.

THEORY OF AIRFOIL RESPONSE IN A GUSTY ATMOSPHERE. PART 2: RESPONSE TO DISCRETE GUSTS OR CONTINUOUS TURBULENCE

L. T. Filotas Nov. 1969 30 p refs

(Grants AF-AFOSR-0672A-67; NRC A-2003)

(AD-700774; UTIAS-141; AFOSR-69-3089TR) Avail: CFSTI CSCL 1/3

The response of an infinite span airfoil in an arbitrary two-dimensional upwash field is studied analytically on the basis of the aerodynamic transfer function giving the pressure distribution in an inclined sinusoidal gust derived in Part I (AD-700 773). When the upwash field can be completely specified (discrete gust case) the lift response is expressed as a quadrature involving the transfer function. When only statistical properties of the upwash can be specified (atmospheric turbulence) mean square values, correlation functions and power spectra are similarly expressed. Certain results are given in closed form. Expressions giving the transfer function in terms of correlations which may be determined experimentally are given. The detailed expressions deal with the lift response; however, the modification required for the pitching moment response is explicitly stated. Author (TAB)

N70-28320# Royal Aircraft Establishment, Farnborough, (England).

TRANSONIC FLOW WITH HEAT INPUT [SCHALLNAHE STROEMUNGEN MIT WAERMEZUFUHR]

J. Zierep Feb. 1970 14 p refs Transl. into ENGLISH from Acta Mechanica, v. 8, 1969 p 126-132

(RAE-Lib-Trans-1452) Avail: CFSTI

Basic equations for transonic flow around profiles, with heat input, are derived. A nonlinear differential equation of the mixed type with a source term for the heat input is obtained. An approximate solution of this equation is investigated for various

values of the heat input. Here an important role is played by the phenomenon known as critical heat input. It is shown that heat input in the supersonic part of the flow field leads to a reduction of the drag. Author

N70-28418*+ Air Vehicle Corp., San Diego, Calif.
FORTRAN 4 PROGRAM NONCON: NONCONICAL FLOW PAST SLENDER WING BODIES WITH LEADING-EDGE SEPARATION
F. Y. Su Oct. 1969 54 p refs
(Contract NAS2-3523)
(NASA-CR-73447; Rept-358) Avail: CFSTI CSCL 20D

A listing and instructions is reported for program NONCON for which the mathematical development is presented. The computer program determines the distribution of lift, pitching moment, and pressure on nonconical slender bodies with leading-edge separation. Input data is obtained from Program SMITH which is valid for conical wing-bodies only. The program is written in FORTRAN 4 language for the CDC 3600 digital computer. With only minor modifications the program has been adapted for the IBM series 7040 and 7090 computers. Author

N70-28453# Nielsen Engineering and Research Inc., Palo Alto, Calif.
PREDICTION OF SUPERSONIC LAMINAR FLOW SEPARATION BY THE METHOD OF INTEGRAL RELATIONS WITH FREE INTERACTION Technical Report, 20 May 1968 1 Jul. 1969
Gary D. Kuhn, Frederick K. Goodwin, and Jack N. Nielsen Jan. 1970 104 p refs
(Contract F33615-68-C-1499)
(AD-702104; NEAR-TR-17; AFFDL-TR-69-87) Avail: CFSTI CSCL 20/4

The report describes the development of a predictive method for calculating separated laminar boundary layers on flat-plate-wedge and cylinder-flare configurations in supersonic flow and the application of the method to predicting the effects of Mach number, Reynolds number, and temperature ratio on the properties of the boundary layer. The purpose of the report is to extend previous analytical work employing the method of integral relations to the region downstream of reattachment and to describe an interative technique developed to produce a unique solution. The theory is shown to produce good comparisons with pressure data on flat-plate-wedge configurations for both adiabatic and cold walls. Accounting for non-Blasius initial velocity profiles produced by favorable pressure gradients upstream of the beginning of interaction was shown to decrease the predicted extent of separation. For axisymmetric configurations the length of an equivalent cylinder must be calculated by an auxiliary method. Good to fair comparisons with experimental pressure distributions were produced by adjusting the equivalent cylinder length. Fair comparison was produced between the theory and experimental heat-transfer rate data on an ogive-cylinder-flare configuration. The theory is shown to predict an incipient separation wedge angle which agrees reasonably well with experimental results. Author (TAB)

N70-28500*# Air Vehicle Corp., San Diego, Calif.
NONCONICAL THEORY OF FLOW PAST SLENDER WING BODIES WITH LEADING-EDGE SEPARATION
M. H. Y. Wei, E. S. Levinsky, and F. Y. Su [1969] 59 p refs
(Contract NAS2-3523)
(NASA-CR-73446) Avail: CFSTI CSCL 20D

A theoretical method is presented for calculating the nonlinear lift and pressure distribution on nonconical slender wing-body combinations exhibiting leading-edge separation. The theory is based upon the flow model in which a pair of spiral vortex sheets is assumed to spring from the wing leading edges and roll up into two vortex cores. A general solution which depends on conical initial conditions is found for the pressure continuity equation on the vortex sheet. The continuity of normal velocity condition across the vortex sheet is extended to account for the twist of the vortex sheet along the body axis. The zero-force condition on the vortex core and cut is modeled after Bryson, who developed a nonconical approach without vortex sheet effects. Based on this theory, a computer program was developed which predicts lift, pitching moment, and pressure distribution as a function of axial station for slender configurations with curved leading edges and curved body shapes of circular or elliptical cross sections. Variable wing incidence is also included in the analysis in order to predict nonlinear longitudinal control effectiveness. Author

N70-28649*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LOW-SPEED STATIC STABILITY AND CONTROL CHARACTERISTICS OF TWO SMALL-SCALE, HYPERSONIC CRUISE CONFIGURATIONS
Delma C. Freeman, Jr. and Richard S. Jones Washington Jun. 1970 27 p refs
(NASA-TM-X-2021; L-7134) Avail: CFSTI CSCL 20D

The two models investigated were a distinct wing-body and a blended wing-body configuration. The investigation shows that the distinct wing-body configuration with a center of gravity located at 0.51 of the mean aerodynamic chord (landing configuration) is statically longitudinally unstable up to the stall and directionally unstable at angles of attack above about 8 deg. The blended wing-body configuration with a center of gravity at 0.37 of the mean aerodynamic chord is statically longitudinally unstable over most of the test angle-of-attack range and directionally stable up to the stall. Author

N70-28782*# General Motors Corp., Indianapolis, Ind. Allison Div.
EXPERIMENTAL INVESTIGATION OF ADVANCED CONCEPTS TO INCREASE TURBINE BLADE LOADING. PART 6: PERFORMANCE EVALUATION OF MODIFIED TANDEM ROTOR BLADE
H. G. Lueders Washington NASA Jun. 1970 27 p refs
(Contract NAS3-7902)
(NASA-CR-1616; EDR-4909) Avail: CFSTI CSCL 20D

The performance of a single-stage turbine with a modified tandem rotor blade was investigated over a range of equivalent speeds and expansion ratios. Based on tests conducted in a two-dimensional cascade the leading edge of the aft airfoil of the original tandem blade was altered so that the slot between the blades converged from inlet to exit. The cascade tests indicated a significant gain in performance resulting from this modification. The results of this investigation are compared with the performance of the original tandem rotor blade. Both rotors were tested with the same stator. Author

N70-28861# Nationaal Lucht-en Ruimtevaartlaboratorium, Amsterdam (Netherlands).
ON A KERNEL-FUNCTION METHOD FOR THE CALCULATION OF THE PRESSURE DISTRIBUTION ON A TWO-DIMENSIONAL WING WITH HARMONICALLY OSCILLATING CONTROL SURFACE IN SUBSONIC FLOW
R. J. Zwaan Oct. 1968 18 p refs Submitted for publication
(NLR-TR-F-261) Avail: CFSTI

The method presented contains the numerical solution of the Possio integral equation: the pressure distribution is approximated by a series of loading functions of which the coefficients are solved by collocation. Three terms in the series are singular: their type and strength are derived by a consideration of the local flow near the hinge axis. A convergence test on calculated results shows that two of them are important and a comparison with experimental results is given. This method may be extended very well to a wing of finite span. Author (ESRO)

N70-28932# Centre National de la Recherche Scientifique, Meudon (France). Lab. d'Aerothermique.
WAKE OF A SPHERE IN RAREFIED HYPERSONIC FLOW

[SILLAGE D'UNE SPHERE EN ECOULEMENT HYPERSONIQUE RAREFIE]

Henri Coudeville and Jean Bataille Dec. 1969 47 p refs In FRENCH
(Rept-69-5; Publ-364) Avail: CFSTI

A mathematical model of the free molecular hypersonic flow around a sphere is presented. Parameters of the flow are calculated taking into account the molecules in the free molecular flow and the molecules originating in the wall and the results are compared with those for cylinders. ESRO

N70-28941# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.

ANALYSIS OF THE STATIC PRESSURE DISTRIBUTION ON A DELTA WING IN SUBSONIC FLOW

D. L. I. Kirkpatrick 1970 29 p refs Supersedes RAE-TR-68217; ARC-30871
(ARC-R/M-3619; RAE-TR-68217; ARC-30871) Copyright. Avail: CFSTI; HMSO: 15s; BIS $3.20

The static-pressure distribution on the surface of a thin delta wing of aspect ratio 1.616 was measured at several incidences in subsonic flow, and the results were analyzed to investigate the development of the leading-edge vortices. The results were compared with those obtained from earlier tests to demonstrate how the chordwise distribution of aerodynamic loading on a slender wing is affected by its aspect ratio, thickness, and wing-tip shape. Author (ESRO)

N70-28966# Queens Univ., Belfast (Northern Ireland). Dept. of Aeronautical Engineering.

EFFECTS OF SUCTION ON THE INTERACTION BETWEEN SHOCK WAVE AND BOUNDARY LAYER AT A COMPRESSION CORNER

L. H. Tanner and S. L. Gai London Aeron. Res. Council 1970 30 p refs Sponsored by Min. of Technol. Supersedes ARC-28770
(ARC-CP-1087; ARC-28770) Copyright. Avail: CFSTI; HMSO: 7s; BIS: $1.50

The report describes work carried out in a supersonic wind tunnel at a Mach number of 1.93 on the interaction produced by wedges of 8 deg, 12 deg and 16 deg angle. The wedges could be raised from the tunnel floor through distances comparable with the boundary layer thickness, and suction was applied at the resulting slot. The pressure distributions and boundary layer traverses show how the suction reduces and eventually eliminates the separation region, causing the flow to approach that of ideal fluid theory. Estimates of optimum suction quantity and bleed height area obtained. Author (ESRO)

N70-28967# Queen Mary Coll., London (England). Dept. of Aeronautical Engineering.

A THEORETICAL INVESTIGATION FOR DELTA WINGS WITH LEADING-EDGE SEPARATION AT LOW SPEEDS

R. K. Nangia and G. J. Hancock Aeron. Res. Council 1970 53 p refs Supersedes ARC-30608
(ARC-CP-1086; ARC-30608) Copyright. Avail: CFSTI; HMSO: 12s; BIS: $2.50

A non-linear lifting surface theory is postulated which incorporates the leading-edge separations, by extending Brown and Michael's slender wing model, but satisfies the Kutta trailing-edge condition. Results of a numerical application to a delta wing indicate acceptable trends compared with experimental data. Author (ESRO)

N70-28969# Centre National de la Recherche Scientifique, Meudon(France). Lab. d'Aerothermique.

HOT WIRE MEASUREMENTS IN SUPERSONIC FLOW FOR INVESTIGATING A BOUNDARY LAYER WITH INJECTION [MESURES AU FIL CHAUD EN ECOULEMENT SUPERSONIQUE EN VUE DE L'ETUDE D'UNE COUCHE LIMITE AVEC INJECTION]

Michel Cornil and Jean-Francois Devillers Apr. 1970 29 p refs In FRENCH
(Rept-70-2; Publ-368) Avail: CFSTI

This report describes measurements in the boundary layer of a flat plate using helium or argon injection. A hot-wire constant-temperature anemometer was used to measure the velocity and temperature profiles in supersonic flows. The variations of the Nusselt number downstream from the shock was investigated for Reynolds numbers in the range 1 less than Re2 less than 80. In this range the heat transfer evolves monotonically from continuous flow to free molecular flow. For low values of the Reynolds number the heat transfer depends essentially on the gas studied. The thermal parietal coefficient varies from 0.95 for continuous flow to values greater than 1 for low Reynolds numbers. It will therefore be necessary to take those variations into account when making temperature measurements in the boundary layer. ESRO

N70-28970# Laboratoire d'Aerothermique du C.N.R.S., Bellevue (France).

STUDY OF AERODYNAMIC FORCES ON FLAT PLATES AND DIHEDRONS IN RAREFIED GAS FLOW AT MACH 8 [ETUDE DES FORCES AERODYNAMIQUES SUR DES PLAQUES PLANES ET DES DIEDRES DANS UN ECOULEMENT DE GAZ RAREFIE A MACH 8]

Georges Herpe (Ph.D. Thesis-Paris Univ.) 1969 101 p refs In FRENCH
Avail: CFSTI

Previous results concerning flat plates in hypersonic rarefied flow at zero incidence have been generalized to take into account plates with non-zero incidence or dihedrons with blunted edges. The distribution of the aerodynamic coefficients is discussed particularly the effects due to wall friction. Tests of the theory were performed in a strong interaction regime with a Mach number of 8.1 and a Reynolds number of 2,200 per cm. Very sensitive measuring equipment had to be designed because of the low pressures involved. Author (ESRO)

N70-29063# Centre National de la Recherche Scientifique, Meudon (France). Lab. d'Aerothermique.

TECHNIQUES FOR THE MEASUREMENT OF AERODYNAMIC FORCES AND HEAT FLUX IN RAREFIED GAS FLOW [TECHNIQUES DE MESURES DES FORCES AERODYNAMIQUES ET DES FLUX THERMIQUES DANS DES ECOULEMENTS DE GAZ RAREFIE]

Jean Allegre, Jean-Claude Festinger, and Georges Herpe Nov. 1969 43 p refs In FRENCH; ENGLISH summary Sponsored by Direc. des Rech. et Moyens d'Essais
(Rept-69-6; Publ-365) Avail: CFSTI

This paper gives a brief description of the methods used to measure very small aerodynamic forces and to record heat fluxes in rarefied flow conditions. The three-component balance was fitted with strain gauges and compensating resistances were used in the gauge networks to eliminate temperature effects. Aerodynamic forces up to 50 grams could be recorded and changes in component values as low as 0.05 grams could easily be detected. Heat flux measurements are somewhat critical when the output signal induced by the applied heat flux is of the order of the background noise. Such measurements need additional item such as amplifiers and filters. The report described a simple resistance-capacity network with a thin-film surface-thermometer which records the heat flux directly. Author (ESRO)

N70-29084# Centre National de la Recherche Scientifique, Meudon (France). Lab. d'Aerothermique.

STUDY OF SEPARATION, IN ISOVOLUME FLOW, ON A FLAT PLATE WITH SINUSOIDAL CORRUGATIONS [ETUDE DES DECOLLEMENTS, EN ECOULEMENT ISOVOLUME, SE PRODVISANT SUR UNE PLAQUE PLANE A PAROI SINUSOIDALE]

Gia Ban Diep, Thanh Son Duong, Pierre Gougat, and Bernard

Prunet-Foch Feb. 1970 62 p refs In FRENCH Sponsored by Direc. des Rech. et Moyens d'Essais Prepared jointly with Nord-Aviation (Rept-70-1; Publ-367) Avail: CFSTI

In order to investigate transition phenomena in incompressible flow and the variations inside a boundary layer due to a perturbation produced by low-amplitude harmonic corrugations of a wall, the flow separations on flat plates and on sinusoidal corrugated plates with a/lambda = 1/200 and 1/400 were studied. The pressure measurements and frequency analyses were compared. It is concluded that micro-separation occurred at the surfaces of the corrugated plates and that their influences on the transition phenomena were not negligible. The laminar separation and the laminar attachment phenomena are also discussed. ESRO

N70-29135# Laboratorie d'Aerothermique du C.N.R.S., Bellevue (France)

STUDY OF A HYPERSONIC RAREFIELD FLOW AROUND DELTA WINGS [ETUDE D'UN ECOULEMENT HYPERSONIQUE RAREFIE AUTOUR D'AILES DELTA]

Jean-Claude Festinger (Ph.D. Thesis--Paris Univ.) 1969 146 p refs In FRENCH
Avail: CFSTI

The aerodynamic and heat transfer characteristics of 60 deg and 70 deg sweptback delta wings at variable incidence in a Mach 8 hypersonic rarefied flow are reviewed. This problem is discussed theoretically, and the experimental equipment, including the special three-component aerodynamic balance, is described along with the friction effects. Author (ESRO)

N70-29199# Royal Aircraft Establishment, Farnborough (England).

CALCULATION OF THE FLOW ABOUT WINGS OF ARBITRARY PLANFORM AT A WIDE RANGE OF ANGLES OF ATTACK [RASCHET OBTEKANIYA KRYLEV PROIZVOLNOI FORMY V PLANE V SHIROKOM DIAPAZONE UGLOV ATAKI]

S. M. Belotserkovskii Feb. 1970 25 p refs Transl. into ENGLISH from Mekhan. Zhid. i Gaza (USSR), v. 4, 1968 p 32-44
(RAE-Lib-Trans-1433) Avail: CFSTI

A lifting surface in attached subsonic flow in the wing plane is extended by adding vortex lines shed from the side edges of the wing. These, and the vortex lines shed from the trailing edge, are allowed to assume positions in space where they follow the local flow direction. The segment strengths of the vortex lines are determined by a collocation method based on the quarter-chord theorem. The positions and strengths are found iteratively for each angle of incidence, starting with an initial approximation based on a smaller incidence. The solution for vanishing incidence is that for attached flow. For a rectangular wing of unit aspect ratio, calculations of lift, pitching moment, spanwise lift distribution, chordwise circulation distribution, and vortex configuration are presented. Comparisons are made with measured values of lift and moment for this wing and for a constant-chord wing of unit aspect ratio and 45 deg sweep tested by Gersten. Author

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N70-27898# Naval Ordnance Lab., White Oak, Md.

A NEW APPROACH TO THE DETERMINATION OF THE STEADY-STATE INFLATED SHAPE AND INCLUDED VOLUME OF SEVERAL PARACHUTE TYPES

William P. Ludtke 11 Sep. 1969 73 p refs
(AD-702041; NOLTR-69-159) Avail: CFSTI CSCL 1/3

A new approach is presented to obtain the steady-state inflated shape of the gore mainseam and the canopy volume of flat circular, 10 percent extended skirt, elliptical, hemispherical, 18 percent porous ring slot, 24 percent porous ribbon in 12- and 16-gore configurations and cross-type parachutes. The canopies are demonstrated to closely elliptical in cross section. The axis ratios of the ellipses are derived from photographic coverage of wind-tunnel tests of models of each type of parachute. Wind-tunnel tests were conducted at various velocities from 17 mph to 200 mph using flat parachute models of approximately 40-inch diameter and shaped gore models of approximately 26-inch inflated diameter. Axis ratios, scale factors, and methods of computing the coordinates of the inflated canopy shape are presented. A new approach to the steady-state volume of the parachute, which includes the volume of the billowed gore and an air volume ahead of the skirt hem of the canopy, is given. The results of this investigation are particularly applicable to studies of canopy stress analysis and determination of the volume of air, which must be collected during canopy inflation process for use in the calculation of opening-shock force. Author (TAB)

N70-27928# Pioneer Parachute Co., Inc., Manchester, Conn.

PROTOTYPE CLUSTER-PARACHUTE RECOVERY SYSTEM FOR A 50000 POUND UNIT LOAD. VOLUME 2: DIRECT DESIGN ASPECTS Final Report, May 1968 - Jan. 1969

Royce A. Toni and Milan M. Knor Jan. 1969 128 p refs
(Contract DAAG17-68-C-0142)
(AD-701005; USANLABS-TR-69-83-AD) Avail: CFSTI CSCL 1/3

The report covers the direct design aspects of the selected prototype cargo recovery assembly for airdropping heavy unit loads in the order of 50,000 pounds. The detailed design of the components is covered as well as stress analysis to determine the margins of safety for the materials selected. Material lists and weights for the components are provided. Laboratory testing of individual components and strength efficiency of stitch patterns are shown. Author (TAB)

N70-28018*# Lockheed Missiles and Space Co., Sunnvale, Calif.

HYPERSONIC CRUISE VEHICLE WING STRUCTURE EVALUATION

P. P. Plank, I. F. Sakata, G. W. Davis, and C. C. Richie Washington NASA May 1970 170 p refs
(Contract NAS1-7573)
(NASA-CR-1568) Avail: CFSTI CSCL 1/3

An investigation was conducted to provide both theoretical and experimental data to support the selection of the best structural concept for the design of a hypersonic wing structure. Various combinations of promising primary structures, heat shields, and leading-edge design concepts were analyzed for the wing of a specified hypersonic cruise vehicle to operate at Mach 8, at a maximum dynamic pressure of 2200 lb/sq ft, and with a life-span of 10,000 hr. The results of earlier studies were supplemented by an in-depth analysis, which was conducted in accordance with design criteria and included extensive computer modeling, transient structural thermal and load predictions, and synthesis procedures for structural optimization. After initial and intermediate screening, six wing-structure concepts were selected and subjected to in-depth structural analysis, including: optimum rib and spar spacing, optimum thermal-protection arrangements, oxidation penetration, eccentricities, nonoptimum factors, manufacturing penalties, panel flutter, wing flutter, sonic fatigue, load fatigue, and creep. The leading edge required additional and separate analyses, such as low-cycle fatigue. Author

N70-28046*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

FLIGHT AND SIMULATION INVESTIGATION OF METHODS FOR IMPLEMENTING NOISE-ABATEMENT LANDING APPROACHES

Harvey C. Quigley, C. Thomas Snyder, Emmett B. Fry, Leo J. Power, Robert C. Innis et al. Washington May 1970 121 p refs
(NASA-TN-D-5781; A-3080) Avail: CFSTI CSCL 01C

A flight and simulator investigation has been conducted to determine methods for implementing steep two-segment and decelerating landing approaches. For the research jet transport used in the study a reduction in noise of approximately 11 PNdB (9EPNdB) at a point 1.1 nautical miles from the runway threshold was achieved with a two segment approach with an upper segment of 6 deg and a lower segment of 2.65 deg which intercepted at an altitude of 250 feet. The two segment profiles with an intercept at 400 feet reduced noise about 10 PNdB at a point 1.5 nautical miles and 13 PNdB (11 EPNdB) at a point 3.4 nautical miles from the threshold. Decelerating approaches on a normal approach angle (2.65 deg) reduced noise only moderately 3 to 4 PNdB, but combining decelerating with steeper or two segment approaches reduced noise 11 PNdB (9 EPNdB) at a point 1.1 nautical miles from the runway threshold. The noise abatement landing approach profiles evaluated in this program could be flown in a modified jet transport with the same precision as conventional instrument landing approaches without a significant increase in pilot workload. The pilots preferred two segment approach profiles with an intercept altitude of 400 feet. Author

N70-28444# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Porz (West Germany).
CONTRIBUTION TO THE HISTORY OF THE GERMAN RESEARCH INSTITUTE FOR GLIDING FLIGHT [BEITRAG ZUR GESCHICHTE DER DEUTSCHEN FORSCHUNGSANSTALT FUER SEGELFLUG]
W. Georgii Mar. 1969 29 p refs In GERMAN
(DLR-Mitt-69-04; DVL-890) Avail: CFSTI

A brief history of the German Research Institute for Gliding Flight is presented from the founding of its predecessor institutes in 1924 until 1961, when it was converted to the Scientific Research Institute for Aviation in Munich. In addition to conducting research related to the sport of gliding, the institute also engaged in studies of atmospheric physics, flight mechanics, and aircraft design. Photographs are presented to show the different types of aircraft designed by researchers at the institute. Transl. by R.B.

N70-28451# School of Aerospace Medicine, Brooks AFB, Tex. Otolaryngology Branch.
NOISE ENCOUNTERED IN ROTARY-WING AIRCRAFT Final Report, Feb. 1962 Apr. 1969
Donald C. Gasaway Dec. 1969 35 p refs
(AD-702422; SAM-TR-69-87) Avail: CFSTI CSCL 20/1

The acoustic environment within rotary-wing aircraft consists of a mixture of noises. The report identifies, describes, and illustrates the primary and secondary noise-producing mechanisms associated with helicopter operation. The noise sources include main rotors, antitorque rotors, main and secondary transmission and gear-shaft distribution systems, and auxiliary power units. In addition to describing specific noise generators, the report presents composite noise envelopes illustrating typical noise environs of rotary-wing vehicles having different configurations of rotor - to - power plant matings. Alterations in internal noise which occur during conditions of hover and forward flight are described and aeromedical factors such as speech interference and potential auditory risk are identified. Author (TAB)

N70-28674*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
FLIGHT COMPARISON OF SEVERAL TECHNIQUES FOR DETERMINING THE MINIMUM FLYING SPEED FOR A LARGE, SUBSONIC JET TRANSPORT
David A. Kier Washington Jun. 1970 37 p refs
(NASA-TN-D-5806; H-590) Avail: CFSTI CSCL 01C

Three techniques were used in the flight tests: (1) the Federal Aviation Regulations (FAR) Part 25 demonstration technique; (2) a flight path 1-g-break technique; and (3) a constant-rate-of-climb technique. The effect of thrust on minimum speed is analyzed. Results indicate that the flight path 1-g-break technique is the best overall technique. The constant-rate-of-climb technique, or minimum level-flight speed, though highly affected by the deceleration dynamics of the maneuver, is an acceptable alternate for the 1-g-break technique. The FAR demonstration technique, when analyzed by two current analysis methods, is found to yield the least conservative results. However, if the analysis were based on actual airplane maximum lift capability, the technique would yield acceptable results. Author

N70-28775# Royal Aircraft Establishment, Bedford (England). Aerodynamics Dept.
SPEED STABILITY AND THE LANDING APPROACH WITH AN APPENDIX OF AVRO 707A: LONGITUDINAL CHARACTERISTICS
K. J. Staples 1970 56 p refs Revised Supersedes RAE-TR-67322; ARC-30362
(ARC-R/M-3613; RAE-TR-67322; ARC-30362) Copyright. Avail: CFSTI; HMSO: £ 1 10s; BIS $5.40

The effect of speed stability on pilot workload and accuracy on the approach has been investigated with the Avro 707A research aircraft. Speed instability was simulated by a reversed autothrottle which applied thrust in response to changes in airspeed, or in airspeed and incidence. No correlation was found between the speed stability parameter and the accuracy achieved in speed holding and flight path control. The pilot's throttle usage, however, varied consistently with the speed stability time constant, and was little affected by the type of talkdown control used. Marked changes in throttle usage corresponded well with pilots assessments of the difficulty of the task. Results of flight measurements of the longitudinal characteristics of the aircraft in the approach configuration are also included in an appendix. Author (ESRO)

N70-28939# Royal Aircraft Establishment, Farnsborough (England). Aerodynamics Dept.
A FLIGHT SIMULATION STUDY OF THE HANDLING CHARACTERISTICS OF A SLENDER WING SUPERSONIC TRANSPORT AIRCRAFT AT LANDING APPROACH SPEEDS
D. H. Perry and A. Mc Pherson 1970 63 p refs
(ARC-R/M-3616) Copyright. Avail: CFSTI; HMSO: £ 1 12s; BIS $5.85

A ground based flight simulator was used for piloting assessments of the handling characteristics of a slender wing supersonic transport aircraft during the landing approach. The simulation included two methods of representing the outside visual world, and, for some of the tests, cockpit motion in pitch and roll was also used. The effects of turbulence, and the improvements in handling which could be brought about by autostabilization were studied. Data is presented in the form of pilots' assessments on an opinion rating scale, measurements of the accuracy of performing landing approaches, and time histories of control usage and aircraft response. Handling assessments compared with the predictions of existing handling qualities criteria was also made. Author (ESRO)

N70-28960# Naval Aerospace Medical Inst., Pensacola, Fla.
SAMPLE HELICOPTER FLIGHT MOTION DATA FOR VESTIBULAR REFERENCE
W. Carroll Hixon and Jorma I. Niven 2 Nov. 1969 42 p refs Prepared jointly with Army Aeromedical Res. Lab.
(AD-701696; NAMI-1094; USSARL-70-3) Avail: CFSTI CSCL 6/19

The report presents low-frequency linear and angular motion flight data collected on a noninterference basis aboard the following military helicopters: AH-1G, UH-1B, UH-1D, OH-6A, CH-54, CH-47, and UH-2B. Measurement data recorded during various tactical maneuvers and routine flight operations included the triaxial linear

accelerations occurring along the roll, pitch, and yaw axes and the triaxial angular velocities occurring about the same three reference axes. Author (TAB)

N70-28971# Royal Aircraft Establishment, Bedford (England). Aerodynamics Dept.
A REVIEW OF RECENT RESEARCH ON HANDLING QUALITIES, AND ITS APPLICATION TO THE HANDLING PROBLEMS OF LARGE AIRCRAFT. PART 3: LONGITUDINAL HANDLING
P. L. Bisgood 1970 72 p refs Supersedes RAE-TR-68022; ARC-30600
(ARC-R/M-3606; RAE-TR-68022; ARC-30600) Copyright. Avail: CFSTI; HMSO: £1 y16s 6d; BIS $7.20

Recent research into longitudinal handling problems, based mainly on work with fighter-type aircraft, is reviewed and the results discussed with a view to formulating handling criteria. Using these results as a basis, together with ad hoc data, an attempt is made to synthesize handling criteria applicable to large aircraft. Separate criteria are advanced for the 'operational zone' and the landing approach. Because our knowledge of the factors involved remains rather rudimentary, the criteria proposed are incomplete and, in some areas, speculative. Author (ESRO)

N70-28993# Royal Aircraft Establishment, Bedford (England). Aerodynamics Dept.
A DISCUSSION OF SOME JET-LIFT V/STOL AIRCRAFT CHARACTERISTICS AND THEIR LIKELY EFFECT ON OPERATIONAL APPLICATIONS
D. Lean London Aeron. Res. Council 1970 89 p refs Supersedes RAE-TR-66150; ARC-28443
(ARC-CP-1082; RAE-TR-66150; ARC-28443) Copyright. Avail: CFSTI; HMSO: £1; BIS: $3.78

Some of the characteristics of jet-lift V/STOL aircraft are discussed in terms of their effect on the ability of these aircraft to operate from small, semi-prepared sites, without the usual airfield facilities, in both good and bad visibility. Accumulated experience from experimental operations with jet-lift aircraft has been used as a basis for a tentative extrapolation to situations and conditions not yet (in 1964) examined in flight. Attention is drawn to what appear to be some outstanding problem areas, and suggestions are made regarding a possible future program of theoretical, model, and full-scale work. Author (ESRO)

N70-28997# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany). Statisches Buero.
TEMPERATURE PROBLEMS IN LIFT ENGINE NACELLES FOR VTOL TRANSPORT AIRCRAFT [TEMPERATURPROBLEME AN HUBGONDELN FUER VTOL-TRANSPORTER]
M. Flemming *In* WGLR Rept. on the 15th WGLR Meeting on Struct. and Aeroelasticity Dec. 1968 p 24-50 refs In GERMAN (See N70-28995 14-32)
Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 10, 92 DM

A vertical take-off Dornier DO 31 transport aircraft is fitted with wing-tip lift nacelles containing four Rolls-Royce RB 162-4 engines for the transition and gliding phases of the aircraft. A survey is given of temperature problems in flier units such as fire and operational temperature problems and temperature stresses in relation to the rigidity of the nacelles. ESRO

N70-29010*# West Virginia Univ., Morgantown.
UNITED STATES AIR TRANSPORTATION, 1980 NASA Langley Research Center/West Virginia University Summer Predoctoral Fellowship Program in Engineering Systems Design, 1969
Robert Vos, ed. 1969 361 p refs
(Contract NSR-49-001-039)
(NASA-CR-110204) Avail: CFSTI CSCL 15E

The total system operating cost for air transportation was minimized by determining the optimum fleet and type of aircraft using a computerized simulation of the air transportation system. The simulation represents the 21 major air transportation hubs across the nation and is assumed to be representative, but incomplete model of the actual system. The results specify the best system for the 1980s in terms of the vehicles required. Knowing the vehicle configurations, the necessary terminal facilities required for the expected demands can be determined. Terminal saturation is considered for passenger handling capacity and in runway/airway congestion. The social constraints upon the system are also investigated. Author

N70-29133# Vereinigte Flugtechnische Werke G.m.b.H., Bremen (West Germany).
FOCKE-WULF A47/FW47 WEATHER RECONNAISSANCE AIRCRAFT [WETTERFLUGZEUG FOCKE-WULF A47/FW47]
1968 51 p refs In GERMAN *Its* Monografie Nr. 1
Avail: CFSTI

An aircraft is described which has remained almost unknown, although some dozens were made for high altitude weather flights from German airports from 1934 to 1944 to collect data for the air traffic control service. ESRO

N70-29150# Vereinigte Flugtechnische Werke G.m.b.H., Bremen (West Germany).
LOW-WING FOCKE-WULF A36-S48 MONOPLANE [TIEFDECKER FOCHE-WULF A36-S48]
1969 56 p refs In GERMAN *Its* Monografie Nr. 2
Avail: CFSTI

This monograph briefly reviews the previous history of the mail plane A36, the first low-wing monoplane constructed by Focke-Wulf, and the requirements for the design of the Mastgans. The time schedule, specification, aircraft plans, wind tunnel model, and details of the wings are given, and a second low-wing monoplane, the two-seat training plane S48 is mentioned. ESRO

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N70-27914# Clevite Corp., Cleveland, Ohio. Electronic Research Div.
RESEARCH ON THE MECHANISM OF THE PHOTOVOLTAIC EFFECT IN HIGH EFFICIENCY CdS THIN-FILM SOLAR CELLS Final Technical Report, 1 Jun. 1966 - 31 May 1969
L. R. Shiozawa, F. Augustine, G. A. Sullivan, J. M. Smith, III, and W. R. Cook, Jr. Wright-Patterson AFB, Ohio AFL Oct. 1969 211 p refs
(Contract AF 33(615)-5224)
(AD-702095; ARL-69-0155) Avail: CFSTI CSCL 20/12

Three years of research on the operating mechanisms of the CdS thin-film solar cell are described in this report. The essential information contained in all reports previously issued under this contract has been reassembled. New information, not previously reported include data on the antimonochromatic spectral response of different types of cells, measurements of the threshold voltage for electrolytic deposition of copper from Cu2S, observations on the formation of copper whiskers on Cu2S by heating, X-ray crystallographic data on low-temperature phase transformations of cuprous sulfide, measurements of optical transmission of Cu-saturated CdS single crystals, data on the photoconductive rise and decay times of Cu-compensated CdS, discussion of the beneficial role of oxygen in promoting the photovoltaic effect during cell fabrication, and the subsequent degrading effects of oxygen during high temperature exposure. Author (TAB)

N70-27951*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE AND LOSSES OF A dc STARTER-GENERATOR FOR SMALL LOW-COST JET ENGINES
David S. Repas [1970] 22 p refs
(NASA-TM-X-52802) Avail: CFSTI CSCL 10B

Test results on a dc starter-generator are presented. As a generator, this machine was rated 30 volts and 150 amperes for a speed range of 8100 to 12,100 rpm. Data given are for the machine operating as a generator and include saturation curves, losses and efficiency, temperatures, and voltage regulation with a regulator. For an output of 28 volts and 150 amperes, efficiency ranged from 75.3 percent at 8100 rpm to 71.5 percent at 12,100 rpm. The generator was run with the voltage regulator. For a load current of 150 amperes, voltage varied from 27.2 to 27.9 volts over the speed range of 8100 to 12,100 rpm. Author

N70-28098*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
REDUCTION OF ALTERNATOR APPARENT-POWER REQUIREMENTS AND HARMONIC DISTORTION CAUSED BY PHASE-CONTROLLED PARASITIC LOADS
Leonard J. Gilbert and Dennis A. Perz [1970] 10 p refs
Proposed for presentation at the 5th Intersoc. Energy Conversion Eng. Conf., Las Vegas, Nev., 21-24 Sep. 1970; sponsored by AIAA
(NASA-TM-X-52811) Avail: CFSTI CSCL 10B

The loading effect on an alternator as a result of using phase-controlled parasitic loads is shown by analysis and by test results. Because of their nonsinusoidal nature, phase-controlled parasitic load currents increase alternator apparent power (volt-ampere) requirements and introduce harmonic currents. The analysis reveals the extent to which subdividing the parasitic load reduces these unwanted effects. Test results confirm very well the reduction in apparent-power predicted by analysis. Test results also confirm the predicted reduction in load-current harmonics with parasitic load subdivision. The agreement between analytical and experimental results with respect to harmonic content, however, is limited by test circuit parameters not included in the theoretical analysis. Author

N70-28121*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECTS OF CARBON DIOXIDE ON TRAPPED ELECTROLYTE HYDROGEN-OXYGEN, ALKALINE FUEL CELLS
L. H. Thaller, R. E. Post, and R. W. Easter [1970] 12 p refs
Proposed for presentation at the 5th Intersoc. Energy Conversion Eng. Conf., Las Vegas, Nev., 21-24 Sep. 1970; sponsored by AIAA
(NASA-TM-X-52812) Avail: CFSTI CSCL 10B

Trapped electrolyte alkaline fuel cells are presently being used in aerospace applications. Low temperature versions of these systems appear to offer certain advantages over the Apollo-type fuel cell. However, the life characteristics of these low temperature cells have been somewhat disappointing. This analysis explains certain types of early failures of these cell systems. The effects of trace quantities of carbon dioxide in the reactant gases are investigated with particular attention paid to the progressive decrease in the electrolyte volume in cells that are operated under conditions of constant electrolyte vapor pressure. Attention is also directed to the changes in electrochemical characteristics of the electrolytes caused by the formation of potassium carbonate and to the composition of the electrolyte relative to the phase boundary between the single (liquid) phase and the two-phase (liquid plus solid) region. Author

N70-28210*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Guidance and Control Div.
MARINER VENUS 67 SOLAR PANEL
J. V. Goldsmith, W. Hasbach, and R. Yasui 15 Apr. 1970 34 p
(Contract NAS7-100)
(NASA-CR-109960; JPL-TR-32-1321) Avail: CFSTI CSCL 10B

The design, manufacture, assembly, testing, and performance of the solar array that was used for the Mariner Venus 67 mission are described. Also included are remarks on the adequacy of the solar array design and recommendations for the design of solar panels for future missions of the Mariner Venus 67 type. Author

N70-28421*# Lockheed Missiles and Space Co., Sunnyvale, Calif. NASA Agena Systems Engineering.
SERT 2 SOLAR ARRAY Final Report
4 May 1970 141 p revised
(Contract NAS3-11512)
(NASA-CR-72706; LMSC-A941440-Rev) Avail: CFSTI CSCL 10B

The module level test program of those tests are reported which were required to demonstrate that the flight worthiness of the original solar array module design had not been invalidated by the modifications required by the SERT II Program, and that the SERT II solar arrays would withstand the vibration levels of a THORAD launch. The following tests were conducted: (1) deployment mechanism engineering evaluation tests, (2) release mechanism evaluation tests, (3) vibration confidence tests, and (4) flight acceptance tests. A thorough review of the designs, hardware, test programs, test data, engineering analysis, and product assurance assessments of the SERT II Solar Array has been completed. It is concluded that the solar arrays are flight worthy. Author

N70-28433*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESCRIPTION AND EVALUATION OF DIGITAL-COMPUTER PROGRAM FOR ANALYSIS OF STATIONARY OUTSIDE COIL LUNDELL ALTERNATORS
Gary Bollenbacher Washington Jun. 1970 119 p refs
(NASA-TN-D-5814) Avail: CFSTI CSCL 10B

A digital computer program for analyzing the electromagnetic design of Lundell alternators is presented. The program, which is written in FORTRAN 4 programming language, is briefly described. The calculational methods are outlined or appropriate references are cited. Calculated results for a 14.3-kVA alternator are compared with experimental data. The comparison identifies two sources of error in the program: the rotor leakage permeance, which affects the field excitation calculation; and the no load pole-face loss, which, if large compared to other losses, affects the accuracy of the efficiency calculation. Despite these sources of error, the agreement between calculated and experimental data is reasonable, and the program is useful for parametric analysis and design optimization. Author

N70-28473*# Tyco Labs., Inc., Waltham, Mass.
DEVELOPMENT OF UNIFORM AND PREDICTABLE BATTERY MATERIALS FOR NICKEL-CADMIUM AEROSPACE CELLS Interim Annual Report, 8 Aug. 1968 - 7 Jul. 1969
Jul. 1969 55 p refs
(Contract NAS5-11561)
(NASA-CR-110078) Avail: CFSTI CSCL 10C

The preparation of porous nickel plaques are described for use in development of nickel cadmium batteries. The porous plaque is impregnated with nickel or cadmium hydroxide to form positive and negative plates, and the plates are tested to determine the conditions under which uniform behavior can be achieved. The sintering characteristics of the carbonyl nickel powders used in the process were determined in loose sintering experiments. A slurry coating process for the preparation of nickel plaque was established. R.B.

N70-28867*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HYDRAULIC FLUID ANALYSIS FOR ANTENNA DRIVE SYSTEMS
J. J. Lombardo and W. J. Logan, Sr. Apr. 1970 37 p Submitted

for publication
(NASA-TM-X-63923; X-525-70-148) Avail: CFSTI CSCL 13G

Filtration in fluid power systems is employed to eliminate those foreign particles which tend to produce component wear and possible catastrophic failure. To ensure that the hydraulic system filters are cleaning the fluid, and also to permit detection of a component's impending failure, a program of periodic fluid analysis is performed. The Manned Space Flight Network site personnel have been supplied with fluid sampling kits which allow an initial fault detection capability. In addition, fluid specimens are forwarded to GSFC, Code 525 for detailed analysis. It is the purpose of this program to develop a systematic approach to contamination control, and to establish a level of acceptability by which system reliability may be improved. Author

N70-28714*# Hughes Research Labs., Malibu, Calif.
HIGH VOLTAGE SOLAR ARRAY STUDY Final Report
W. Knauer, J. R. Bayless, G. T. Todd, and J. W. Ward May 1970 193 p refs
(Contract NAS3-11535)
(NASA-CR-72675) Avail: CFSTI CSCL 10B

A detailed feasibility study of high voltage solar arrays, capable of 15 kW at 2 to 16 kV, has been performed. The major area considered are plasma power losses, dielectric stresses, and questions relating to high voltage design, fabrication, and testing. The general conclusion reached is that, except for minor modifications, conventional array designs can be utilized on most missions. Missions which require operation in the lower regions of the ionosphere at the higher voltages or for extended time periods can involve severe plasma power losses. Methods are discussed for reducing such losses. Author

N70-28726*# Electric Storage Battery Co., Yardley, Pa. Carl F. Norberg Research Center.
ELECTROCHEMISTRY OF SYSTEM: HEAT STERILIZABLE IMPACT RESISTANT CELL DEVELOPMENT Final Report, 30 Sep. 1967 - 31 Mar. 1970
G. F. Nordblom and A. M. Chreitzberg Apr. 1970 54 p ref Prepared for JPL
(Contracts NAS7-100; JPL-951296)
(NASA-CR-110137) Avail: CFSTI CSCL 10B

Research and development is reported for a high energy density cell capable of heat sterilization in the unformed condition, formation decontamination with ethylene oxide, survival of launching vibration and high impact shock upon landing on a distant planet, and delivery of four complete electrical discharge cycles. Support metals were investigated for impact resistant cells which are compatible with the silver-zinc system. Author

N70-28846*# Electric Storage Battery Co., Raleigh, N.C. Exide Missile and Electronics Div.
HEAT STERILIZABLE IMPACT RESISTANT CELL DEVELOPMENT Quarterly Reports, 1 Oct. 1969 - 31 Mar. 1970
G. F. Nordblom and A. M. Chreitzberg Apr. 1970 46 p refs Prepared for JPL
(Contracts NAS7-100; JPL-951296)
(NASA-CR-110136) Avail: CFSTI CSCL 10B

Sixteen ampere-hour cells cycled at 100% depth of discharge after wet heat sterilization maintain capacity best to 69 cycles when ZnO/Ag weight ratio is in range 1.2 to 1.5 to 1. Electrolyte limitation restricts performance of higher ratio cells if sufficient electrolyte is not provided for the excess of ZnO. A statistical analysis of capacities delivered to date in the 27 cell experiment is included. 70 ampere-hour rechargeable primary cells have passed sine, and random vibration tests at JPL. In vertical vibration plane at 25 g voltage drops occurred unless both positive and negative plate tabs were insulated with plastic sleeves. 27 cells have been manufactured for long term reliability tests. Twenty-five ampere-hour cells, designed for intermediate cycle life after heat sterilization and 8-month interplanetary cruise have demonstrated 168 cycles at 50% depth of discharge with only a short stand life after sterilization. Similar cells, cycled before heat sterilization give about 50% less cycle life. A third group, having a wet stand life with six deep cycles of 9 months, is being environmentally tested at JPL before cycling per mission profile. Author

N70-28923*# Idaho State Univ., Pocatello. Dept. of Chemistry.
INVESTIGATION OF ELECTRODE MATERIALS FOR ALKALINE BATTERIES Quarterly Report
G. Myron Arcand 25 May 1970 12 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952265)
(NASA-CR-110135; QR-8) Avail: CFSTI CSCL 10B

Heating AgO at 65 deg, even for relatively short periods, "activates" the material to adsorb atmospheric gas at room temperature. In order to remove the adsorbed gas, subsequent heating must be for a longer time at 65 deg or at a higher temperature. Repeated heating and cooling over a period of about one month resulted in a net increase in weight of about 160 micrograms, which corresponds to a relative increase of 0.5%. Commercial Ag_2O, held at room temperature without prior treatment for a period of about 13 days, showed a relative weight increase of about 1.6%. This is about the same increase observed over the same period with freshly made Ag_2O prepared by thermal reduction of AgO. A cell has been constructed consisting of a AgO cathode and K(Hg) anode in 10 VF KOH. The initial OCV was 2.08 V when the cell was charged to 0.000317 A-hr. On standing with a recorder as the only load, the cell maintained its OCV above 2.03 V for 44 hours. The voltage dropped to 1.8 V after 63 hours and to 0.5 V after 77 hours. A K(Hg) electrode in contact with saturated KOH was discharged after standing 254 days and showed an 85% charge recovery. Author

N70-29061# European Space Research and Technology Center, Noordwijk (Netherlands).
NICKEL-CADMIUM, SILVER-CADMIUM, AND SILVER-ZINC BATTERIES
G. Seibert Sep. 1969 26 p refs Presented at the 6th ESRO Summer School, Noordwijk, Neth., 1968
(ESRO-TN-81) Avail: CFSTI

The purpose of this paper is to consider the capabilities and major limitations of nickel-cadmium, silver-cadmium, and silver-zinc alkaline battery systems. Discussions are given of the problems associated with the use of these systems in the hermetically sealed form for space applications. The current state-of-the-art and the development work underway on these systems are also presented. Author (ESRO)

N70-29105# European Space Research and Technology Center, Noordwijk (Netherlands).
BATTERY CHARGE CONTROL
A. Werner Prevkschat Sep. 1969 21 p refs Presented at the 6th ESRO Summer School, Noordwijk, Neth., 1968
(ESRO-TN-82) Avail: CFSTI

The problems of excessive battery overcharge and methods for the safe control of battery charge aboard satellites are discussed. Descriptions are presented for both electronic and electrochemical charge control devices that have been developed, or are being developed, and are likely to be used in current spacecraft programs. Author (ESRO)

N70-29169*# Illinois Univ., Chicago.
MAGNETOHYDRODYNAMIC INDUCTION GENERATOR EXPERIMENTAL STUDY Final Technical Report
15 Apr. 1970 45 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952453)
(NASA-CR-110154) Avail: CFSTI CSCL 10B

The results of an experimental study of a one-wavelength MHD induction generator operating on a liquid flow are presented. The design philosophy and the experimental generator design are briefly summarized, including a description of the flow loop and

instrumentation. The measurements without the fluid or fluid channel are given followed by the results obtained for the fluid flow without the magnetic field. Various generator test results are presented, including normal operation when excited from the 60 hertz power line, and operation from the power line with the end coils shorted to reduce magnetic fringing. Both cases were also operated in the self-excited mode with external capacitors to supply the required reactive power. The harmonic content of the terminal voltage was measured, hypothetical accidents simulated, and two-wavelength tests performed. Author

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N70-27809# Mayo Clinic, Rochester, Minn. Cardiovascular and Human Centrifuge Labs.

SCINTISCANNING SYSTEM FOR STUDY OF REGIONAL DISTRIBUTION OF BLOOD FLOW Final Report, Jan. 1968 - Sep. 1969

Earl H. Wood, Craig M. Coulam, William Dunnette, James F. Greenleaf, David Nathan et al Feb. 1970 206 p refs

(Contract F41609-68-C-0022)

(AD-702421; SAM-TR-70-6) Avail: CFSTI CSCL 6/12

The effect of changes in the direction and magnitude of the gravitational-inertial force environment on the regional distribution of impacted 35-micron diameter microspheres has been measured in the lungs of six anesthetized chimpanzees. These distributions were determined by two computer-controlled scintiscans at 760 sites covering the dorsal and ventral surfaces of the thorax at 1 G subsequent to four injections of differentially isotope-tagged microspheres into the right ventricular outflow tract. Pulse-height analysis at each site allowed separation of count values for the isotopes, and, after correction for collimator distortion, these values were assumed to be proportional to the respective blood flows which were present below each site at the respective time of injections. Computer-generated 3-dimensional and contour map displays of the scintiscan and related physiologic data indicate that pulmonary blood flow tended to redistribute toward the midthoracic region during acceleration exposures concomitantly with large decreases in arterial oxygen saturation presumably from pulmonary shunting via the dependent regions of the lung. The decrease in blood flow to the superior regions of the lung coupled with the finding of no change or decrease in flow to the dependent regions of the lung suggests that selective increases in resistance to blood flow to the dependent, presumably anoxic, region of the lung occurred which were responsible for the reduction in level of physiologic shunt frequently found in these animals toward the end of the exposure to 5.8 Gy. Author (TAB)

N70-27814# School of Aerospace Medicine, Brooks AFB, Tex.

ACCEPTABILITY AND EFFECTIVENESS OF AN INGESTIBLE TOOTHPASTE Final Report, Jan. 1964 - Jun. 1967

Gaylord L. Hall, Albert C. Jerman, and Cecil E. Brown, Jr. Dec. 1969 10 p refs

(AD-702154; SAM-TR-69-84) Avail: CFSTI CSCL 6/5

An ingestible toothpaste was tested during the course of a simulated space flight conducted to study the effect on man of living in an atmosphere of approximately 100% oxygen. Four young male adults spent 43 days in a space cabin simulator at a pressure equivalent to 27,000 ft. of altitude. The dental phase was to determine the acceptability of the ingestible toothpaste and whether any change in the oral health of the subjects took place as a result of the flight. The ingestible toothpaste was acceptable; however, because of the small number of subjects, results were inconclusive as to the effectiveness of the oral hygiene protocol. Author (TAB)

N70-27832# School of Aerospace Medicine, Brooks AFB, Tex.

REDUCTION OF RADIATION HAZARD IN TRITIUM METHOD OF MEASURING TOTAL BODY WATER Final Report, Jul. - Sep. 1969

Donald F. Logsdon, Jr., James F. Green, and John W. Harper Nov. 1969 11 p refs

(AD-702155; SAM-TR-69-82) Avail: CFSTI CSCL 6/18

The current procedure for measurement of total body water in vivo using a 250 microcurie dose of tritiated water produces 18.98 mrads of total body radiation. It was found that the amount of radiation activity (number of counts) necessary for usable test results could be achieved as effectively by extending the counting time or increasing the amount of serum sampled. These changes in procedure allowed for a reduction in the total amount of tritiated water administered to 25 microcuries. Increasing the counting time reduced the exposure dose by a factor of 5; doubling the serum sampled decreased the exposure dose by a factor of 2; combining these two procedures decreased the total body exposure by a factor of 10. If a lower degree of test accuracy can be accepted, the amount of activity measured can be reduced and the dose of tritiated water correspondingly decreased. Author (TAB)

N70-27833# School of Aerospace Medicine, Brooks AFB, Tex.

ENDOCRINE HOMEOSTASIS IN DOGS UNDER NONHYPOXIC-HYPOBARIC CONDITIONS Final Report, Feb. - Oct. 1969

Gordon L. Coppoc and Shelton J. Leger Dec. 1969 12 p refs

(AD-702156; SAM-TR-69-91) Avail: CFSTI CSCL 6/19

Plasma insulin concentration, 17-hydroxycorticosteroid (17-OHCS) secretion rate, and norepinephrine (NE) secretion were studied in dogs anesthetized with sodium pentobaribital and exposed to 100% oxygen at 259 torr. The 17-OHCS secretion rate was also studied in dogs breathing 100% oxygen at 760 torr. The secretion rates of NE and 17-OHCS were estimated by direct measurements on blood collected from a cannula inserted into the left lumboadrenal vein of each dog. No change was detected in plasma insulin concentration. Slight increases in NE secretion were noted in 2 of 3 dogs exposed to the low pressure. The secretion rate of 17-OHCS increased to about 25% of maximum values during exposure to 100% oxygen at 760 torr and at 259 torr. However, the values over time were different for the two pressures. Peak 17-OHCS secretion occurred after 15 minutes at 259 torr (90 minutes on 100% oxygen), but not until 135 minutes on oxygen at 760 torr. This indicates that dogs may be mildly stressed by breathing 100% oxygen and that there is a stress associated with hypobarism that cannot be attributed to hypoxia. Author (TAB)

N70-27838# School of Aerospace Medicine, Brooks AFB, Tex.

STRONTIUM METABOLISM WITH SPECIAL CONSIDERATION OF GENETIC EFFECTS Final Report, Sep. - Oct. 1969

John D. Crissman and John H. Kirk Jan. 1970 28 p refs *Its* Aeromed. Rev. No. 1-70

(AD-702029; SAM-TR-70-3) Avail: CFSTI CSCL 6/18

Strontium metabolism is reviewed to determine possible correlations between Strontium-90, fallout and decreased decline in infant mortality rates. Strontium fallout characteristics, metabolism and reproductive tract kinetics are discussed. Articles making positive correlations between Strontium-90 fallout and the apparent decrease in expected continued decline in infant mortality rates are present. Strontium-90 was found to be capable of producing lethality and genetic mutations. The significances of strontium, however, as the sole or predominant influence on infant mortality is questioned due to lack of knowledge concerning strontium reproductive kinetics and absence of studies with parameters such as magnitude of dose and route of administration which are comparable to those produced at current fallout levels. Author (TAB)

N70-27840# School of Aerospace Medicine, Brooks AFB, Tex.
D-AMPHETAMINE MORTALITY AND RELATED LEVELS IN TISSUE OF RATS EXPOSED TO ALTITUDE Final Report, Feb. May 1969
Albert T. Bernardini Dec. 1969 12 p refs
(AD-702032; SAM-TR-69-75) Avail: CFSTI CSCL 6/15

Two groups of Sprague-Dawley rats were injected with d-amphetamine sulfate and the number of dead animals was recorded after 2 hours. One group of rats was exposed to a simulated altitude of 12,000 ft. in a low-pressure chamber for 1 hour; the other, the control group, was observed at ground level for the 2-hour duration. After an approximate LD50 dosage of d-amphetamine sulfate (20 mg./kg.) was established at ground level, three dose levels were administered within each group--10 mg. /kg., 15 mg. /kg., and 20 mg. /kg. Mortality observed in the altitude group was approximately one-third greater than that in the control group. Doses which showed equivalent mortality were then administered to separate groups--10 mg. /kg. to an altitude group and 20 mg. /kg. to a ground-level group. A combination of labeled 14C-d-amphetamine and unlabeled amphetamine sulfate was used. The data suggest that the potency of amphetamine increases at altitude, and that the difference in mortality may be due to mechanisms dependent on tissue concentration of amphetamine.
Author (TAB)

N70-27844*# Exotech, Inc., Washington, D.C.
ANALYTICAL TECHNIQUES IN PLANETARY QUARANTINE Final Report
May 1970 139 p refs
(Contract NASw-1734)
(NASA-CR-109886; TRSR-70-13) Avail: CFSTI CSCL 06F

Results of work done in the areas of planetary quarantine requirements, microbial survival, analytical techniques, and planetary chemical contamination are presented. Separate discussions center on microbial resistance to sterilization, estimation buried contamination, and microbial release through fracture and erosion.
J.M.C.

N70-27845*# Exotech, Inc., Washington, D.C.
POTENTIAL EFFECTS OF RECENT FINDINGS ON SPACECRAFT STERILIZATION REQUIREMENTS
S. Schalkowsky, L. B. Hall, and R. C. Kline *In its* Anal. Tech. in Planetary Quarantine May 1970 18 p refs (See N70-27844 14-04)
(Contracts NASw-1558; NASw-1666)
Avail: CFSTI CSCL 06F

An evaluation is made of the probability of release of viable organisms from the spacecraft as a function of: (1) impact velocity magnitudes and the probability of their occurrence; (2) the degree of equipment fracturing at impact velocities; and (3) the number of viable organisms in spacecraft materials. Work being done to quantify each of three types of contamination, i.e. that on open surfaces, mated surfaces and buried contamination, is described in the context of seeking an approach to spacecraft sterilization that would be most compatible with the implementation of planetary missions. It is concluded that the results of work now in progress on spacecraft material fracturing, on the estimation of buried contamination loads and on microbial resistance on mated surfaces may lead to less severe dry heat sterilization of planetary spacecraft than was considered necessary in the past.
Author

N70-27846*# Exotech, Inc., Washington, D.C.
INVESTIGATIONS INTO A DIFFUSION MODEL OF DRY HEAT STERILIZATION Interim Report
M. J. Barrett *In its* Anal. Tech. in Planetary Quarantine May 1970 refs 18 p (See N70-27844 14-04)
(TRSR-041) Avail: CFSTI CSCL 06M

The analytical model described in this study formalizes the hypothesis that dry heat inactivation of microorganisms is closely related to the water content of the spore and its micro-environment. Experimental data are examined relative to this model and it appears to be valid. This model is aimed at overcoming the well known deficiencies of the logarithm model.
Author

N70-27847*# Exotech, Inc., Washington, D.C.
AN ANALYTICAL BASIS FOR ASSAYING BURIED BIOLOGICAL CONTAMINATION Interim Report
Robert C. Kline and Phillip L. Randolph *In its* Anal. Tech. in Planetary Quarantine May 1970 30 p refs (See N70-27844 14-04)
(TRSR-038) Avail: CFSTI CSCL 06M

Presented herein is an analysis of a procedure for assaying biological contamination buried or embedded in spacecraft materials. The procedure requires the controlled fracture of representative samples of a material whose buried loading is of interest. Each sample is tested for biological contamination on the totality of surfaces exposed as a result of the fracturing process. The basic datum or observation consists of the proportion of samples which yield contamination upon culturing. Conventional statistical techniques, combined with an assumed relation between the mean concentration of organisms buried within the material and the observed datum, produce an upper bound estimate for the unknown mean concentration, expressed to any prescribed level of confidence. In principle, the conservativeness of the resulting estimate is directly related to the sample size and the amount of surface area exposed by fracture; as the sample size and/or exposed area increase(s) the difference between the estimate and the unknown mean load tends to decrease.
Author

N70-27848*# Exotech, Inc., Washington, D.C.
THE RELEASE OF BURIED MICROBIAL CONTAMINATION BY AEOLIAN EROSION
Matthew J. Barrett and J. Lyndon Woodall *In its* Anal. Tech. in Planetary Quarantine May 1970 16 p refs (See N70-27844 14-04)
(TRSR-70-14) Avail: CFSTI CSCL 06F

The implications of fracturing and exposing of surfaces which might instantaneously or subsequently release viable spores are considered. The relatively slow process of erosion is examined although the fracture and the erosion phases are not necessarily independent. The fracture-ratio is defined as the area exposed through fracture divided by the volume of the sample. An expression for the erosion of spherical shaped particles and an expression for the probability of release given that a quantity of the sample erodes in the quarantine period were derived. Calculations based on experimental data were made for the erosion rate.
Author

N70-27849*# Exotech, Inc., Washington, D.C.
IMPLEMENTATION OF A CHEMICAL CONTAMINANT INVENTORY FOR LUNAR MISSIONS
In its Anal. Tech. in Planetary Quarantine May 1970 35 p refs (See N70-27844 14-04)
(TRSR-70-07) Avail: CFSTI CSCL 06F

The detailed procedures and tasks to be undertaken to collect, evaluate, store, and disseminate data which will serve anticipated needs of lunar sample investigators, consistent with the requirement that costs associated with implementation and operation of the inventory be consistent with known needs for this information are considered. A set of recommendations for implementing the chemical materials inventory in accordance with the guidelines set forth is also included.
Author

N70-27850*# Sandia Corp., Albuquerque, N. Mex. Planetary Quarantine Systems Studies Div.
A MATHEMATICAL MODEL FOR THE THERMORADIATION INACTIVATION OF DRY BACILLUS SUBTILIS VAR. NIGER SPORES
Virgil L. Dugan Apr. 1970 21 p refs
(NASA Order W-12853)
(NASA-CR-109885; SC-RR-70-203) Avail: CFSTI CSCL 06M

This paper first presents the development of an empirically

based kinetic model which describes the synergistic inactivation of dry Bacillus subtilis var. niger spores by a combined heat and gamma radiation environment. The mechanism of this inactivation is investigated by comparing the resulting empirical model parameters with analogous parameters of a free-radical mediated polymerization reaction. A theoretical chemical kinetic model of bacterial inactivation is then derived assuming a free radical reaction. This theoretical model demonstrates the same form as the empirically based model and is capable of predicting a method for obtaining additional synergistic gain. This predicated method was subsequently tried and the prediction was experimentally verified, lending additional credence to the theoretical kinetic model.
Author

N70-27851*# National Aeronautics and Space Administration. Manned Spacecraft Center, Langley Station, Va.
CREW MICROBIOLOGY EVALUATION FOR APOLLO MISSION 101 Test Plan
C. P. Truby 29 Aug. 1968 42 p
(NASA-TM-X-62930) Avail: CFSTI CSCL 06M

Bacteriology and mycology tests were performed to evaluate the microbiological profiles of crew members from Apollo Earth Orbital Mission 101. Postflight and preflight tests were performed in order to determine if pathogenic organisms were present and the effects of space flight on the microbiological flora of astronauts. Other efforts were geared toward cataloging data of the normal flora of astronauts so that possible lunar contaminates can be isolated and identified during the Apollo mission to the moon.
J.M.C.

N70-27852*# Sandia Corp., Albuquerque, N. Mex. Planetary Quarantine Dept.
AN INTERACTIVE COMPUTER INFORMATION SYSTEM FOR PLANETARY QUARANTINE FOR LUNAR PROGRAMS
A. L. Roark and A. L. Wyer Jul. 1968 87 p
(NASA Order R-09-019-040)
(NASA-CR-109863; SC-RR-68-545) Avail: CFSTI CSCL 06F

A data management system is described which gathers and stores spacecraft biocontamination data with respect to lunar exploration programs. The major elements of the system are described with emphasis on the software system. Specifications for a software package are listed as follows: a routine to establish the data files, a routine to store information in the data files, a routine to update the lunar inventory, and a communication system. Flow charts are provided to explain the purposes of these routines. A number of incomplete subroutines are also included in defining the details of the system.
J.M.C.

N70-27856# Bureau of Commercial Fisheries, Seattle, Wash. Technological Lab.
GROWTH AND TOXIN PRODUCTION OF CLOSTRIDIUM BOTULINUM TYPES E, NONPROTEOLYTIC B, AND F IN NONIRRADIATED AND IRRADIATED FISHERIES PRODUCTS IN THE TEMPERATURE RANGE OF 38 F TO 50 F Annual Progress Report
M. W. Eklund and F. T. Poysky Jul. 1969 33 p refs
(Contract AT(49-7)-2442)
(TID-25231) Avail: CFSTI

Following treatment with mitomycin C, cell lysates were examined with the electron microscope and bacteriophages were found for each of the different types of Clostridium botulinum. Procedures are outlined for isolation of bacteriophage for non-toxigenic organisms resembling C. botulinum types B, E, and F and detection of phage using the agar overlay technique. Experiments were conducted on curing nonproteolytic type F C. botulinum of its lysogenic state with ultraviolet light. Studies were conducted on factors in raw irradiated oysters that prevent production or destroy botulinum toxin.
NSA

N70-27872# School of Aerospace Medicine, Brooks AFB, Tex.
A DICHOTOMIZING SPEECH DISCRIMINATION TEST Final Report, 1 Jul. 1967 - 15 Feb. 1968
Roy Danford, Jr. and Vernon C. Bragg Dec. 1969 12 p refs
(AD-702031; SAM-TR-69-90) Avail: CFSTI CSCL 6/16

A new speech discrimination test was formulated by extracting selected words from recordings of the Harvard PB-50 lists. Fifty words were chosen which had been found to be significantly more difficult for patients with sensorineural hearing losses to recognize than for those with normal hearing. Three groups of subjects were tested with the dichotomizing speech discrimination test.
Author (TAB)

N70-27876# School of Aerospace Medicine, Brooks AFB, Tex.
ESTIMATION OF ARTERIAL BLOOD PRESSURE BY VISUAL OBSERVATION OF SPHYGOMOMANOMETER NEEDLE OSCILLATION Final Report, Jan. - Apr. 1969
N. Bruce Chase Dec. 1969 15 p refs
(AD-702030; SAM-TR-69-86) Avail: CFSTI CSCL 6/16

A study of the needle oscillation method of blood pressure measurement was made using 6 normotensive adult females as subjects and observers. The mean systolic values for this method were found to be higher and the mean diastolic values lower than with the conventional (Korotkoff) method and, therefore, apparently closer to true (direct method) values. By correcting the average of 2 needle oscillation readings by the difference of the means, it was predicted with 90% confidence that one could expect 75% of the needle oscillation determinations to be within 7.5 mm. Hg systolic and 10.0 mm. Hg diastolic; or that 90% would be within 10.7 mm. Hg systolic and 14.7 mm. Hg diastolic of the conventional value. These values are less than, or do not greatly exceed, the acceptable limit of 8 mm. Hg difference established by the American Heart Association for two separate conventional readings. It would appear, therefore, that the oscillation method may have considerable potential value for use in environments with high noise levels where the conventional method cannot be used. A difference was found in the ability of different observers to use this method. The two most accurate observers each made 10 errors in 40 determinations, while the least accurate observer made 17 errors in 40 determinations.
Author (TAB)

N70-27890# Central Electricity Generating Board, Berkeley (England). Research and Development Dept.
BIOLOGICAL ASPECTS OF SKIN IRRADIATION. PART 2: SKIN THICKNESS CORRECTIONS TO DOSE ESTIMATES
J. T. Whitton Nov. 1969 14 p refs
(RD/B/N-1480) Avail: AEC Depository Libraries

The reliability of skin dose measurements depends critically on values assumed for the depth below the skin surface and the thickness of the skin layer occupied by the biologically sensitive tissue (basal layer). The main errors in using skin dosimeters, employing both lithium fluoride in powder form and in teflon discs, arise through discrepancies between the thicknesses of the containing sachet window and phosphor layer when compared with the thicknesses of the protective and sensitive skin layers. Preliminary results from an experimental survey of probable skin dimensions at various body sites are quoted and data are presented by which skin dose estimated using these new parameters differs from that measured by a thermoluminescent skin dosimeter. The conclusions may be used to indicate the magnitude and direction of errors in dose estimations.
Author (NSA)

N70-28140# Georgia Univ., Athens. Dept. of Physics and Astronomy.
INTEGRATION OF THEORY AND EXPERIMENT INTO A UNIFIED CONCEPT OF VISUAL PERCEPTION Final Report, 1 Mar. 1966 - 30 Apr. 1969
Heinz Von Foerster and Humberto R. Maturana Dec. 1969 120 p refs
(Contract AF 49(638)-1680)
(AD-700782; AFOSR-70-0281TR) Avail: CFSTI CSCL 6/16

The study postulates the functional and organizational unity of living organisms and demonstrates this unity through matematical

models and neurophysiological investigations. Experimentally, color vision is interpreted through neural organization of the retina. A model with a multi-level goal structure is described whose main organizational feature is a nonpredictive heterarchy of decision systems in which no one os the goals always predominates. Its activity is determined by a competitive interaction among the goals. Author (TAB)

N70-28165# Texas Univ., Austin. Electronics Research Center.
AN APPLICATION OF SPECTRAL ANALYSIS AND DIGITAL FILTERING TO THE STUDY OF RESPIRATORY SINUS ARRHYTHMIA
D. Graham Galloway and Baxter F. Womack 7 Aug. 1969 181 p refs
(Contract F41609-68-C-0020; Grant AF-AFOSR-0766-67)
(AD-701731; TR-71; AFOSR-69-2048TR) Avail: CFSTI CSCL 6/2

Several mathematical techniques were applied to a study of respiratory sinus arrhythmia, the phenomenon by which respiration modulates heart rate in normal humans and in many animals. Data taken from human subjects was used to develop computer processing methods which are useful in simulation studies and in the interpretation of monitored heart rate from remote subjects. The investigation was divided into the following three categories: (1) the development of a mathematical model relating respiration to those variations that it causes in heart rate, (2) the use of digital filtering techniques to attenuate fluctuations in heart rate which are due to respiration, and (3) the development of methods which use only heart rate to get information about respiration. Author (TAB)

N70-28176# Joint Publications Research Service, Washington, D.C.
SPACE BIOLOGY AND MEDICINE, VOLUME 4, NO. 1
28 Apr. 1970 123 p refs Transl. into ENGLISH of the publ. "Kosmicheskaya Biologiya i Meditsina" Moscow, Med. Publishing House, 1970 p 1 - 88
(JPRS-50408) Avail: CFSTI

The articles presented pertain to the effects of space flight stress and radiation on animals and plants. For individual titles, see N70-28177 through N70-28198.

N70-28177# Joint Publications Research Service, Washington, D.C.
DYNAMICS OF GRANULOCYTIC RESERVE CHANGE IN THE BONE MARROW OF ANIMALS EXPOSED TO CHRONIC GAMMA-IRRADIATION
E. S. Zubenkova et al *In its* Space Biol. and Med., Vol. 4, No. 1 28 Apr. 1970 p 1 - 5 refs (See N70-28176 14-04)
Avail: CFSTI

A pyrogenal test is used to study leukopoesis during chronic gamma irradiation. Experimental procedures are described, along with test results showing insignificant variations in the level of granulocytes in dog bone marrow. J.A.M.

N70-28179# Joint Publications Research Service, Washington, D.C.
PLANT CULTIVATION USING KERAMZIT IN CLOSED ECOLOGICAL SYSTEMS
I. V. Tsvetkova et al *In its* Space Biol. and Med., Vol. 4, No. 1 28 Apr. 1970 p 15 - 21 refs (See N70-28176 14-04)
Avail: CFSTI

Plants were cultivated by the hydroponics method using keramzit or alumoferrisilicate as a solid substrate. The chemical composition of keramzit was found to change after use four times in the cultivation of higher plants. As a result of long-term use of the substrate it became degraded, losing certain elements, such as aluminum, to the nutrient solution. This reduced the crop yield and changed the chemical composition of the biomass. Author

N70-28180# Joint Publications Research Service, Washington, D.C.
ACTIVITY OF SOME ENZYMES IN THE BLOOD SERUM OF RATS DURING PROLONGED IMMOBILIZATION
Ye. Ye. Simonov et al *In its* Space Biol. and Med., Vol. 4, No. 1 28 Apr. 1970 p 22 - 25 refs (See N70-28176 14-04)
Avail: CFSTI

The activities of some enzymes in the blood serum during hypokinesia with a duration up to 6 days are studied. Impairments were reflected in the enzymatic spectrum of the blood serum and led to shifts characterizing the disturbance of metabolic processes, as well as the intensity of atrophic and dystrophic changes during prolonged restriction of motor activity. Author

N70-28181# Joint Publications Research Service, Washington, D.C.
HEAT TOLERANCE OF ALBINO MICE AT DIFFERENT RATES OF AMBIENT TEMPERATURE CHANGE
I. P. Scherbachev *In its* Space Biol. and Med., Vol. 4, No. 1 28 Apr. 1970 p 26 - 31 refs (See N70-28176 14-04)
Avail: CFSTI

Study of the effect exerted on the body by a number of extremal factors reveal that the rate at which the factor changes determines the body reaction to it and the nature of the effects from exposure to acceleration, hypoxia, or change in atmospheric pressure. When there is a rapid rise in the ambient temperature the animals die more rapidly than when there is a slow increase, death occurring at a higher body and ambient temperature. When there is a rapid decrease in the ambient temperature the animals also die more rapidly than when there is a slow decrease but death occurs at a lower ambient temperature. Author

N70-28182# Joint Publications Research Service, Washington, D.C.
THEORETICAL AND EXPERIMENTAL PROBLEMS IN STUDYING THE MECHANISMS OF VESTIBULAR NYSTAGMUS
A. N. Razumeyev et al *In its* Space Biol. and Med., Vol. 4, No. 1 28 Apr. 1970 p 32 - 42 refs (See N70-28176 14-04)
Avail: CFSTI

A possible mechanism of vestibular nystagmus is outlined in the form of a mathematical model. The mechanism underlying the development of vestibular nystagmus, the reworking of afferent information from the periphery into controlling signals, and the actuating components of the oculomotor apparatus are discussed. Arguments supporting the formulated concepts of nystagmus genesis are presented. Anatomical and physiological correlates of units in the model are described. Experiments are suggested which may help to modify the modal and better establish a correlation between model components and cerebral structures responsible for nystagmus. Author

N70-28183# Joint Publications Research Service, Washington, D.C.
HUMAN TOLERANCE TO HEAT STRESS
S. M. Gorodinskiy et al *In its* Space Biol. and Med., Vol. 4, No. 1 28 Apr. 1970 p 43 - 48 refs (See N70-28176 14-04)
Avail: CFSTI

The information content of various physiological parameters used to determine heat tolerance limits is discussed. With significant heat elimination from the body surface and heat production, rectal temperature appears to be an inadequate index for evaluating the thermal state of the body. It is shown that human tolerance to heat stress can be changed by the local application of cold. Author

N70-28185# Joint Publications Research Service, Washington, D.C.
STANDARDIZATION OF ADMISSIBLE LIMITS FOR HIGH-INTENSITY NOISE

Ye. M. Yuganov et al *In its* Space Biol. and Med., Vol. 4, No. 1 28 Apr. 1970 p 54 - 59 refs (See N70-28176 14-04)
Avail: CFSTI

The effect exerted on humans by noise of 114 - 116 and 125 - 126 db with an acoustic energy of 500 cps was studied. The auditory thresholds, blood pressure values, and time of response to light stimuli were measured. Sixty-four healthy male test subjects were used in 152 experiments. Adverse changes in the acoustic analyzer, cardiovascular system, and locomotor analyzer were detected during an exposure of 125 - 126 db noise. Taking into account the changes in the thresholds of skin vibrosensitivity when the ear was protected, it is concluded that the skin becomes a second gage for acoustic energy beginning with 125 - 126 db.
Author

N70-28186# Joint Publications Research Service, Washington, D.C.

PECULIARITIES OF HUMAN METABOLIC RATES DURING SIMULATION OF MODIFIED GRAVITY

A. V. Yeremin et al *In its* Space Biol. and Med., Vol. 4, No. 1 28 Apr. 1970 p 60 - 66 refs (See N70-28176 14-04)
Avail: CFSTI

Metabolic rates of four healthy male subjects were measured while walking and running in an erect position on a treadmill and in a supine position. Under normal gravity conditions the metabolic rates of the subjects in a horizontal position were higher than in a vertical position due to the additional work performed by the leg muscles. However, as the gravity was reduced to 1/6 of the body weight the metabolic rates during walking and running decreased by 24 and 28 percent, respectively. This suggests that lowered gravity requires reduced metabolic rates.
Author

N70-28187# Joint Publications Research Service, Washington, D.C.

POSSIBILITIES OF USING CLINICAL DATA FOR VALIDATING ADMISSIBLE RADIATION DOSES DURING EXTENDED SPACE FLIGHTS

A. I. Guskova *In its* Space Biol. and Med., Vol. 4, No. 1 28 Apr. 1970 refs (See N70-28176 14-04)
Avail: CFSTI

Basic sources of information concerning the biological effect of irradiation of human subjects under conditions similar to those which would prevail during extended space flights are evaluated. On the basis of such data the maximum admissible doses of irradiation for cosmonauts, clinical validation of these doses, and the degree of hazard are discussed. The most important work which must be done for clarifying the admissible doses is outlined and the purposes of clinical investigations are specified. The formulation of precise parameters required for extrapolating experimental data for clinical use is considered.
Author

N70-28188# Joint Publications Research Service, Washington, D.C.

MENTAL PERFORMANCE OF SUBJECTS AFTER EXPOSURE TO ACCELERATIONS OF 5 G

A. L. Narinskaya *In its* Space Biol. and Med., Vol. 4, No. 1 28 Apr. 1970 p 72 - 75 refs (See N70-28176 14-04)
Avail: CFSTI

The effect of an exposure to radial accelerations of 3 to 5 g was investigated in 30 pilots of fighter aircraft in the age range from 25 to 33 years. The test subjects performed psychological tests (attention, memory, sensomotor reactions) before and immediately after exposure to radial accelerations of 3 to 5 g (in the Gell classification) for 30 seconds (for every acceleration magnitude. The results reveal that an exposure to accelerations impaired accomplishment of the task by 50 percent on an average in over half the subjects. Exposure to accelerations hinders the formulation or re-arrangement of mental work habits.
Author

N70-28189# Joint Publications Research Service, Washington, D.C.

POSSIBLE CHARACTERISTICS OF THE BASIC STOMATOLOGICAL DISEASES IN THE SIMULATION OF SOME CONDITIONS PREVAILING DURING LONG SPACE FLIGHTS

T. V. Nikitina *In its* Space Biol. and Med., Vol. 4, No. 1 28 Apr. 1970 p 76 - 80 refs (See N70-28176 14-04)
Avail: CFSTI

The physiological reactions of the human body to exposure to a combination of spaceflight factors are considered. Recommendations are made with respect to medical supplies to be carried aboard spaceships for treating the major stomatological diseases.
R.B.

N70-28191# Joint Publications Research Service, Washington, D.C.

PERFORMANCE OF OPERATORS DURING PROLONGED BED CONFINEMENT

Ye. S. Zavyalov et al *In its* Space Biol. and Med., Vol. 4, No. 1 28 Apr. 1970 p 87 - 92 refs (See N70-28176 14-04)
Avail: CFSTI

The efficiency of the control-scanning activity of operators exposed to a 100-day bedrest was examined. Exposure to hypokinetic conditions was shown to reduce greatly the efficiency in systems requiring fine well-coordinated movements. The efficiency revealed the greatest decline on the 40th day of the bedrest experiment. The number of resulting errors increased by a factor of 5 to 6 in comparison with the initial level. This decline was much less for operators who performed physical exercises during the experiment.
Author

N70-28192# Joint Publications Research Service, Washington, D.C.

ULTRAVIOLET FLUORESCENCE OF BIOLOGICAL OBJECTS EXPOSED TO IONIZING RADIATION

S. N. Aleksandrov et al *In its* Space Biol. and Med., Vol. 4, No. 1 28 Apr. 1970 p 93 - 102 refs (See N70-28176 14-04)
Avail: CFSTI

Experiments using changes in ultraviolet fluorescence of biological tissue to determine the effects of irradiation are reviewed. Irradiated living bone marrow cells and blood leukocytes of rats were found to have increased fluorescence. Ascitic tumors in rats and mice were irradiated and transplanted into nonirradiated organisms repeatedly each 8 - 10 days, and the descendents also showed increased fluorescence. Studies of descendents of irradiated rats demonstrated the hereditary transmission of the changes. It was further found that ultraviolet fluorescence increases with increased dose and exposure conditions. Two types of radiation changes were noted: one exerts its effect on fluorescent intensity only when cell vital activity is maintained, and the other has as its basis a type of impairment manifested in both living and dead cells. Changes arising during the irradiation of surviving or dead tissue outside the body were also investigated.
N.E.N.

N70-28194# Joint Publications Research Service, Washington, D.C.

EFFECT OF CHANGE IN DAILY SCHEDULE ON THE DYNAMICS OF ELECTROLYTE EXCRETION

V. P. Krotov et al *In its* Space Biol. and Med., Vol. 4, No. 1 28 Apr. 1970 p 105 - 109 refs (See N70-28176 14-04)
Avail: CFSTI

The urine of two human subjects was collected in fractional portions at four hour intervals. The flame photometry method was used in determining the potassium, sodium, and calcium contents. The results were analyzed by periods based on the duration of changes in the daily schedule. These results based on social sensors were compared with those based on ecological time sensors.
J.A.M.

N70-28195# Joint Publications Research Service, Washington, D.C.

EFFECT OF SOME DRUGS ON ANIMAL TOLERANCE TO EXTREME STRESS

V. Ye Belay et al *In its* Space Biol. and Med., Vol. 4, No. 1 28 Apr. 1970 p 110 113 refs (See N70-28176 14-04)
Avail: CFSTI

A comparative study of neurotrophic drugs effecting acute hypoxic hypoxia, prolonged transverse accelerations, and maximum physical loads is reviewed. The dosage and pharmacological properties of the drug affecting animal tolerances are analyzed. Experimental results are summarized, including tests on psychosedative drugs and tranquilizers. J.A.M.

N70-28196# Joint Publications Research Service, Washington, D.C.

EFFECT OF THE SOMATOTROPHIC HORMONE AND ESCULAMINE ON THE VIABILITY OF RATS UNDER THE INFLUENCE OF ACCELERATIONS

V. G. Ovechkin et al *In its* Space Biol. and Med., Vol. 4, No. 1 28 Apr. 1970 p 114 115 ref (See N70-28176 14-04)
Avail: CFSTI

The effect of hormal drugs on animals during acceleration was studied in rats with injections of STH solution of 1 mg per 100 g of weight, and subjected to accelerations of 20 g in the head-pelvis direction. It was found that human STH considerably increases viability during acceleration of male rats, but reduces the tolerance in female rats. Measurement of pulse and respiration rates during rotation and a 25-minute after-effect period revealed a positive effect of STH on the autonomic functions. F.O.S.

N70-28197# Joint Publications Research Service, Washington, D.C.

CHANGE IN THE CONTENT OF TOTAL PROTEIN AND PROTEIN FRACTIONS IN THE BLOOD SERUM OF RATS IN THE HIGH MOUNTAINS

T. M. Tukhtayev et al *In its* Space Biol. and Med., Vol. 4, No. 1 28 Apr. 1970 p 116 117 ref (See N70-28176 14-04)
Avail: CFSTI

Determinations of the dynamics of the content of total protein and protein fractions in the blood serum of rats were made in the high mountains (3500 m above sea level). The rats were decapitated on the 1st, 3d, 5th, 7th, 10th, 12th, and 15th days after they had been transported to the high mountains. In the valley + or - (850 m above sea level) the concentration of total protein in the serum was 6.8 + or - 0.2 g percent and the protein fractions were determined. A day after the animals were moved to the high mountains there was a decrease in the concentration of total protein. After three days an investigation revealed further changes in the blood protein content. There was a decrease in the total quantity of protein to 5.9 + or - 0.5 g percent against the initial 6.8 + or - 0.2 g percent. There was a reliable decrease in the alpha sub 1 and alpha sub 2-globulin fractions. On the fifth day the content of total protein was also reliably lower than the initial level. There was a continued reduced concentration of alpha sub 1- and alpha sub 2-globulin fractions (0.5 + or - 0.02 and 0.5 + or - 0.02 g percent respectively). Author

N70-28198# Joint Publications Research Service, Washington, D.C.

ELECTROLYTE COMPOSITION OF CEREBROSPINAL FLUID AND CEREBRAL BLOOD IN RABBITS AFTER EXPOSURE TO ACCELERATIONS

A. G. Kuzovkov et al *In its* Space Biol. and Med., Vol. 4, No. 1 28 Apr. 1970 p 118 121 refs (See N70-28176 14-04)
Avail: CFSTI

The experiments were conducted to determine the role of the hemato-encephalic barrier in the mechanism of the observed central nervous system changes. The cerebrospinal fluid from the cisterna magna, plasma of the arterial blood from the femoral artery, plasma of venous blood from the cerebral sinus, and the content of sodium and potassium ions were investigated. The pH of the fluid and the venous and arterial blood was also determined. The coefficient of redistribution of the cations between the fluid and the blood was computed for evaluating the permeability of the hemato-encephalic barrier. The studies indicate that impairment in the functioning of the central nervous system due to exposure to acceleration is associated not only with afferent influences, homodynamic shifts, and cerebral hypoxia, but also with changes in functioning of the hemato-encephalic barrier. Author

N70-28253*# Naval Aerospace Medical Inst., Pensacola, Fla.

MOTION SICKNESS PRODUCED BY HEAD MOVEMENT AS A FUNCTION OF ROTATIONAL VELOCITY

Earl F. Miller, II and Ashton Graybiel 5 Mar. 1970 13 p refs
(NASA Order T-81633; NASA Order R-93)
(NASA-CR-109891) Avail: CFSTI CSCL 06S

Results of tests to measure the stressor stimulus effect of rotational velocity in terms of the number of the standardized head-tilt movements required to evoke a common severity level of symptoms characterizing motion sickness are presented. The accumulative number of standardized head tilts (approximately 90 deg) within the frontal and sagittal planes that were executed in reaching the specific test end-points of either moderate or severe malaise was recorded at each test velocity. Sixteen young healthy subjects were rotated in a laboratory chair at various velocities within a range suitable for each subject and the limits of 1.0 to 30.0 rpm. When individual ability to make head movements without evoking symptoms was exceeded, the average relative stressor effect (E factor) of each head movement varied directly and, in log-log terms, linearly with rotational velocity. These data provide the basis for grading individual susceptibility to the Coriolis type of motion sickness with a single numerical score as well as define the high rate of change of Coriolis stressor effect as a function of rotational velocity, which may find practical application in specifying rotational rates of space stations. Author

N70-28324# Gt. Brit. National Inst. for Research in Nuclear Science, Chilton. Rutherford High Energy Lab.

DEPTH DOSE AND DEPTH DOSE EQUIVALENT DATA AS FUNCTIONS OF NEUTRON ENERGY

K. B. Shaw, G. R. Stevenson, and R. H. Thomas Sep. 1968 15 p refs
(RHEL/M-149) Avail: AEC Depository Libraries

Depth dose and depth dose equivalent data as functions of neutron energy are reported from various authors. Smooth curves were drawn through the sets of data and values for specific tissue depths of dose and dose equivalent per unit fluence as a function of neutron energy from thermal to several GeV are listed.
Author (NSA)

N70-28441# Systems Research Labs., Inc., San Antonio, Tex.

A VISUAL RESPONSE SYSTEM FOR RESEARCH WITH PRIMATES Final Report, Feb. - Aug. 1969

W. E. Rothe Dec. 1969 15 p
(Contract F41609-69-C-0029)
(AD-702158; SAM-TR-69-77) Avail: CFSTI CSCL 5/10

A device was developed that permits measurement of performance of primates, through the visual modality, before and after application of pulsed ionizing radiation. Two platforms were constructed, each featuring 2 degrees of freedom. One accommodates the primate and provides him with a response stick to counteract disturbances or fly the platform in relation to a horizon displayed by the second platform. The second platform carries a large hollow sphere that encircles the primate and displays the horizon as the borderline of dark and translucent segments. This platform can be moved about two axes intersecting at a common center with those of the first platform. The shock-signal circuitry is variable in its basic parameters and adjusts automatically to the magnitude of the error committed. Author (TAB)

N70-28468*# Martin Marietta Corp., Baltimore, Md. Research Inst. for Advanced Studies.
ESTIMATION OF POOL SIZES AND KINETIC CONSTANTS
K. L. Zankel and B. Kok [1970] 39 p refs
(Contracts NASw-1592; AT(30-1)-3706)
(NASA-CR-109958) Avail: CFSTI CSCL 06C

Various methods were used to investigate the nature and number of electron transport components in chloroplasts. Interpretation of kinetic data is given for the dozen or more components in the electron transport chain in terms of chlorophyll. The primary photochemical donors and acceptors and the pools of components in the chain are discussed. S.S.

N70-28536# Miami Univ., Fla. Inst. of Marine and Atmospheric Sciences.
STUDIES WITH TROPICAL AND SUBTROPICAL MICROALGAE Annual Progress Report
J. S. Bunt [1969] 21 p refs
(Contract AT(40-1)-3795)
(ML-70004; TID-25325) Avail: CFSTI

Progress is reported on research in algal and protozoan nutrition, the establishment of bacteria-free algal cultures, screening of bacteria-free cultures for photoheterotrophic capacities, and the physiological and biochemical basis of photoheterotrophy. NSA

N70-28576# Joint Publications Research Service, Washington, D.C.
PSYCHOPHYSIOLOGICAL AND ENGINEERING-PSYCHOLOGICAL ASPECTS OF AVIATION AND SPACE MEDICINE
B. A. Dushkov et al 8 May 1970 13 p Transl. into ENGLISH from Vop. Psikhologii (USSR), v. 16, no. 1, 1970 p 179 - 185
(JPRS-50489) Avail: CFSTI

Summaries of conference papers are presented on the effects of flight factors and methods of increasing human efficiency during flight, investigation of the work of pilots and cosmonauts to determine optimum work methods during flight assignments, improvement of methods of medical selection and crew training, and improvement of closed ecological life support systems. Author

N70-28579# Maryland Univ., College Park. Dept. of Botany.
IN VITRO BIOSYNTHESIS OF PLANT PROTEINS AND NUCLEIC ACID Final Report, 15 Apr. 1965 - 31 Jul. 1969
31 Jul. 1969 6 p refs
(Contract AT(30-1)-3536)
(NYO-3536-13) Avail: CFSTI

An overview of research accomplishments in a program to refine the various components of a cell-free, all-maize model system is presented. These accomplishments include: (1) the isolation and characterization of a polypeptide from the cell-free amino acid incorporating system of maize seedlings; (2) the purification and characterization of the DNA-dependent RNA polymerase from maize seedlings; and (3) the demonstration of a response of dark-grown tissues to illumination in terms of increases in the level of polysomes and polymerase activity. D.L.G.

N70-28592# Joint Publications Research Service, Washington, D.C.
MAN UNDERWATER
V. Nikolyev 11 May 1970 14 p Transl. into ENGLISH from Nauka Zhizn (USSR), no. 3, Mar. 1970 p 13 - 19
(JPRS-50493) Avail: CFSTI

Physiological diving limits are assessed in terms of the depth to which man can descend and the length of time he can remain under water without using any breathing apparatus. The problems inherent in aqualung diving are examined, and the occurrence and prevention of depth intoxication are discussed. The experiments with underwater laboratories or Sealabs are reviewed, and the need for studies on gas exchange methods is stressed. M.G.J.

N70-28622# Joint Publications Research Service, Washington, D.C.
HYPOKINESIA IN MODERN MAN
K. M. Smirnov 11 May 1970 9 p refs Transl. into ENGLISH from Gig. Sanit. (USSR), no. 2, 1970 p 74 - 78
(JPRS-50492) Avail: CFSTI

The need for determining the effects of hypokinesia and the optimal regimen of motor activity and relaxation is discussed. Studies are reviewed on gas exchange, blood circulation, and cardiac activity in athletes, nonatheletes, and persons subjected to a period of inactivity, both during physical exercise and rest. The relation between hypokinesia and emotional stress is considered, and it is pointed out that retarding of the muscular component of emotions is a new factor in the historical development of mankind. The possible significance of restriction of movements in the process of human intellectual development is also mentioned. N.E.N.

N70-28658*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CONTROL OF CELL DIVISION BY THE ELECTRICAL VOLTAGE OF THE SURFACE MEMBRANE
Clarence D. Cone, Jr. [1970] 12 p refs Presented at the Am. Cancer Soc. 12th Ann. Sci. Writers Seminar, San Antonio, Tex., 20 - 25 Mar. 1970
(NASA-TM-X-62916) Avail: CFSTI CSCL 06C

Two basic developments are reported, in cell division theory which may provide the basis for an increased understanding of cancer and new approaches to its control: (1) A fundamental new theory, which proposes that the cellular ionic concentration pattern (caused by the electrical voltage which normally exists across the surface membrane) acts to exert precise control over division in body cells, has been developed and experimentally verified in tests with mammalian cells. (2) This theory has provided, for the first time, an explanation of the functional connection between the two major pathological features of cancer (uncontrolled proliferation and metastasis) and implies that the basic functional aberrancy producing both of these conditions lies in an alteration of the molecular structure of the cell surface. Author

N70-28693# Joint Publications Research Service, Washington, D.C.
HUMAN MOTOR ACTIVITY IN SEALED CHAMBERS AND DURING SPACE FLIGHT
Boris Andreyevich Dushkov 18 May 1970 279 p refs Transl. into ENGLISH of the book "Dvigatelnaya Aktivnost Cheloveka v Usloviyakh Germokamery i Kosmicheskogo Polsta" Moscow, Meditsina, Jun. 1969 p 1 - 320
(JPRS-50535) Avail: CFSTI

Questions touching on changes in the coordination of movements, time intervals, and power reactions in connection with up-to-date data on the physiology of activity are considered. Quantitative characterizations of the stability of a highly-automatic motor act (walking) and specially-selected exercises in various positions during time spent in sealed chambers are discussed. A comparative physiological characterization is offered of the influence of a change in the supply of information in dependence upon the length of time spent in a small-volume chamber, as well as of the extent of the influence of unfavorable factors and individual character traits on the human organism under such circumstances. Scientifically-grounded recommendations are provided to solve a number of questions concerning the guidance of muscular activity and the regulation of movements under extreme conditions. Author

N70-28768 New York Univ., N.Y.
EGO IDENTITY, TIME PERSPECTIVE, TIME CONCEPTUALIZATION, AND PLANNING
Stanley Kaye (Ph.D. Thesis) 1969 159 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 69-21191

The relation among the time variables perspective and

conceptualization, the time variables and planning, and the relation of Ego Identity with these variables is discussed. Four hypotheses were formulated: (1) time conceptualization will vary positively with Ego Identity, (2) time perspective will vary positively with Ego Identity, (3) planning will vary positively with Ego Identity, and (4) a greater relationship will be noted between Ego Identity and conceptual foresight than between Ego Identity and perceptual foresight. Conceptual foresight and perceptual foresight were two factors subsumed under the general term planning. The findings did not support the hypothesized relation between time conceptualization and Ego Identity. The study showed that there is a relation between Ego Identity and both planning and time perspective. Dissert. Abstr.

N70-28815*# State Univ. of New York at Buffalo.
CENTER FOR THEORETICAL BIOLOGY
1969 137 p refs
(Grant NGR-33-015-106)
(NASA-CR-110182) Avail: CFSTI CSCL 06C

Progress is reported on research in nuclear and cytoplasmic inheritance, models of central nervous system and sensory communication, statistical mechanics in biophysical systems, symbolic relational systems, theoretical pharmacology, quantum biochemistry, membranes and surfaces, cancer chemotherapy, and behavioral studies. R.B.

N70-28833*# Techtran Corp., Glen Burnie, Md.
THE PROBLEM OF THE ELECTROMYOGRAPHIC AND MECHANOGRAPHIC CHARACTERISTICS OF THE OPERATION OF THE HUMAN MOTOR APPARATUS DURING EXERCISE [K VOPROSU OB ELEKTROMIOGRAFICHESKOY I MEKHANOGRAFICHESKOY KHARAKTERISTIKE RABOTY DVIGATELNOGO APPARATA CHELOVEKA V PROTESSE UPRAZHNENIYA]
V. S. Averyanov Washington NASA Jun. 1970 11 p refs Transl. into ENGLISH from Nervnaya Systema (Leningrad), No. 7, 1966 p 125 - 131
(Contract NASw-2037)
(NASA-TT-F-12998) Avail: CFSTI CSCL 06P

Experiments were performed on four test subjects, for a total of 80 experiments, involving the flexing and extension of the arm, with recording of bioelectric currents and mechanical movements. The relationships between the recordings were found to fall into three groups, with the following characteristics: There is an initial absence of a clearly expressed maximum of speed during flexing, followed by the appearance of a maximum during the beginning of the movement, and a final shift of the maximum toward the middle of the cycle. Author

N70-28862# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Medizin.
DNA SUBUNITS, THE LINKING PHOSPHOPEPTIDES, AND THE COMPONENTS FOR DNA REPOLYMERIZATION
Richard S. Welsh Jul. 1969 58 p refs Sponsored partly by Am. Heart Assoc., Inc.
(Jul-612-ME) Avail: CFSTI

The aim of this study was to prepare whole, unclumped nuclei, protected against enzymatic activity, and to isolate DNA from them in a form approaching as closely as possible that found in vivo. Two basically different forms of DNA exist: (1) a reversibly polymerized, associated state which gives subunits on EDTA (ethylenediamine tetraacetate) treatment, and (2) an irreversibly polymerized, EDTA-stable state. Protected nuclei gave DNA of type 1, whereas ruptured or Mg-ATP (Mg-adenosinetriphosphate) treated nuclei gave the irreversibly polymerized type 2. It was found that the DNA subunits obtained from protected nuclei could be irreversibly polymerized to given the type 2 DNA described by addition of the chromatographically purified, cell free components: one or more phosphopeptide (PP) fractions, two protein (enzyme) fractions, Mg-ATP, Mg(2+). If any of the components, especially the PP's were omitted, no irreversible polymerization occurred. The detailed procedures for preparation of the non-degraded DAN subunit fractions, and of the phosphopeptides and components needed for repolymerization are described. Author (ESRO)

N70-28898# California Univ., Los Angeles. Lab. of Nuclear Medicine and Radiation Biology.
DIFFERENTIAL EFFECT OF A CHRONIC DOSE OF GAMMA IRRADIATION ON SHRUBS IN THE NORTHERN MOJAVE DESERT
H. W. Kaaz, A. Wallace, and E. M. Romney [1969] 14 p refs
(Contract AT(04-1)-GEN-12)
(UCLA-12-761) Avail: CFSTI

A 33,600 curie Cs-137 gamma source, which was differentially shielded to increase the uniformity of the distribution of irradiation, was set up on a 15 meter tower in the center of a 9 hectare plot in the Rock Valley Area of the Northern Mojave Desert in January 1964. In the spring of 1969 the large majority of 5000 Ephedra nevadensis within the plot failed to produce flowers and very little vegetative growth occurred in contrast to a control plot and to other nonirradiated areas. The cumulative irradiation dose throughout the plot ranged from 3000 to 29,000 R. Irradiation effects on Lycium andersonii were uncertain and effects were doubtful on other species. Ephedra nevadensis and L andersonii have higher nuclear volume than do the other shrub species. Considerable resistance to gamma irradiation was observed for several of the other species present. Author (NSA)

N70-28920# Hamburg Univ. (West Germany). Inst. fuer Allgemeine Botanik.
THE DISINTEGRATION OF n-DECANE AND THE ASSIMILATION OF n-ALKANES BY A MARINE BACTERIUM [DER ABBAU VON UNDECAN UND DIE ASSIMILATION VON N-ALKANEN DURCH EIN MARINES BAKTERIUM]
Albrecht Killinger (Ph.D. Thesis) 1969 90 p refs In GERMAN
Avail: CFSTI

A marine bacterium which can oxidize n-alkanes, was isolated from North Sea water. The influence of the carbon chain length on the disintegration was investigated using n-decane as an example. By comparative analysis of the fatty acid sample after growth on several n-alkanes, the metabolic processes which can turn these substrates into useful carbon sources were investigated. ESRO

N70-29049# Colorado Univ., Denver. Medical Center.
DIGITAL COMPUTER ANALYSIS AND DISPLAY OF THE RADIOISOTOPE SCAN Technical Progress Report
1969 27 p refs
(Contract AT(11-1)-1472)
(COO-1472-27) Avail: CFSTI

A computer program for performing two dimensional fast Fourier transforms of radioisotope scans and carrying out the inversion of the transforms was developed. Methods of using these transforms to accomplish differential and band pass filtering of scans and to enhance scan resolution by deconvolution with a collimator response function are developed. Evaluation of the results of applying these procedures to scans of phantoms and patients' organs are evaluated. Methods developed for digital computer analyses and display of radioisotope scans are described. NSA

N70-29071# Joint Publications Research Service, Washington, D.C.
ENVIRONMENTAL POLLUTION IN THE USSR
30 Apr. 1970 9 p Transl. into ENGLISH from Russian Journals (JPRS-50437) Avail: CFSTI

The planning action taken to reduce noise from automobiles and automobile garages is described. Concern is also voiced about air pollution. S.S

N70-29188# Michigan State Univ., East Lansing. Dept. of Botany and Plant Pathology.
PRIMARY PRODUCTIVITY, CHEMO-ORGANOTROPHY, AND NUTRITIONAL INTERACTIONS OF EPIPHYTIC ALGAE AND BACTERIA ON MACROPHYTES IN THE LITTORAL OF A LAKE. PART 2
Harold LeRoy Allen (Ph.D. Thesis) 1969 201 p refs
(Contract AT(11-1)-1599; Grants NSF BO-15665; NSF GB-6538) (COO-1599-25-Pt-2) Avail: CFSTI

Assessment of epiphytic algal and bacterial in situ community metabolism, and physiological-nutritional interrelationships of macrophyte-epiphyte systems, were investigated in the littoral zone of a small temperate lake from April 1968 through May 1969. Annual primary productivity, chemo-organotrophic utilization of dissolved organic compounds, and field and laboratory studies of macrophyte-epiphyte interactions were monitored by carbon-14 techniques. Qualitative and quantitative photosynthetic pigment composition, and a brief taxonomic examination of the sessile complex, accompanied measurement of field parameters. Productivity measurements of epiphytic algae on artificial substrata colonized in emergent and submergent macrophytic vegetation sites were compared over an annual period with pigment estimates of biomass. The results indicate biomass are not indicative of photosynthetic activity, except during periods of intense productivity. Author

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N70-27882# School of Aerospace Medicine, Brooks AFB, Tex.
HUMAN BODY EFFECT ON SIGNAL PATTERNS OF PERSONAL TELEMETRY TRANSMITTERS Final Report, Mar. Sep. 1969
Henry Buchanan, Willis F. Moore, and Calvin R. Richter Jan. 1970 16 p refs
(AD-702033; SAM-TR-70-4) Avail: CFSTI CSCL 6/2

Measurements of radio frequency signal radiation were made on personal telemetry transmitters within the frequency band of 6 to 280 MHz; first, in free space, and then with the unit on a subject. With the transmitter inductor used as a radiator, horizontally polarized signal radiation patterns were plotted at discrete frequencies throughout the band. The results, obtained by comparing free-space signal patterns with unit-on-subject signal patterns, indicate that the human body has little effect on the radiated signal pattern from 6 to 10 MGz; it operates like an antenna director element from 16 to 60 MHz; it produces a radiated pattern with bidirectional characteristics from 67 to 90 MHz; and it behaves like an antenna reflector from 103 to 230 MHz. Above 230 to 280 MHz, the body seems to have little or no effect on the radiated signal. Author (TAB)

N70-27907# Battelle Memorial Inst., Columbus, Ohio.
US NAVY DIVING GAS MANUAL
Washington US Navy Supervisor of Diving 1 Oct. 1969 198 p refs
(Contract N00014-66-C-0199)
(AD-701566; RR-3-69) Avail: CFSTI CSCL 6/11

The concept of saturation diving has, for the first time, provided promise that practical undersea work can be carried out at depths approaching 1000 feet. The principal objective of this manual is to provide the best available information on gas properties in a form convenient for use in diving research, engineering, and operations. All of the data in this manual are based upon calculation from theoretical relationships, substantiated where experimental information can be found in the literature (as for pure gases), and unsubstantiated where such information does not exist (as for helium-oxygen mixtures). It is felt that the data presented are the best that can be generated today, and that they will be generally satisfactory in the pressure range up to about 500 psi. For the higher pressures used in storing of diving gases, errors are indeterminate and may be significant. Future experimental research is needed to improve the state of knowledge of mixture properties at very high pressures, and to explore the properties of helium-oxygen-nitrogen mixtures. A second objective of this manual is to summarize the present practice regarding choice of breathing-gas mixtures and some of the calculation procedures used in design and operation of diving equipment. An attempt has been made to present these procedures in such a manner that they can be used by both designers and operating personnel. Author (TAB)

N70-27912# Northrop Corp., Hawthorne, Calif.
INVESTIGATION OF VIBRATION AND IMPACT PROTECTION OF THE HUMAN HEAD AND NECK Final Report, 1 Jun. 1966 15 Nov. 1967
T. E. Mattingly, J. W. Felder, and C. F. Lombard Dec. 1969 89 p refs
(Contract AF 33(615)-5119)
(AD-702124; NCL-67-70R; AMRL-TR-69-112) Avail: CFSTI CSCL 6/17

A summary of the investigation leading to the fabrication of a prototype model of a head and neck protective system for aircrew members is presented. The system provides impact, vibration and environmental protection for the wearer from 0 to over 82,000 feet altitude. The system consists of a helmet and a pneumatically operated neck restraint device which is used to stiffen the coupling between the helmet and the wearers torso during vibration and acceleration environments. Author (TAB)

N70-27933# Case Western Reserve Univ., Cleveland, Ohio.
MOTIVATIONAL ENGINEERING FOR PILOT TRAINING Final Report, May 1968 Aug. 1969
Frederick I. Herzberg, Erik K. Winslow, and Melvin S. Majesty Oct. 1969 51 p refs
(Contract F33615-68-C-1535)
(AD-702123; AFHRL-TR-69-3) Avail: CFSTI CSCL 5/9

The study was an investigation of student pilot motivation for, and attitudes toward, the Air Training Commands undergraduate pilot training (UPT) program. The motivation-hygiene approach was used to systematically identify the motivational factors operating in the UPT program. This approach has been used extensively in industry and with success in a non-training military situation. The purposes of the study were: to employ motivation-hygiene theory and critical incident interview methodology for investigation of motivation in a military training situation, specifically, undergraduate pilot training; and to compare the findings from the undergraduate pilot trainee sample with another Air Force sample and samples from industrial organizations. Author (TAB)

N70-28007*# General Electric Co., Philadelphia, Pa. Space Div.
DEVELOPMENT OF A PROTOTYPE WASTE COLLECTION SYSTEM (THE HYDRO-JOHN)
J. J. Reville and R. W. Murray 25 Feb. 1970 80 p
(Contract NAS9-9741)
(NASA-CR-108463) Avail: CFSTI CSCL 06I

A prototype waste collection system for spacecraft type sanitary urine and feces collection techniques for male personnel is described. The system features a manually initiated, automatically controlled anal wash and dry cycle after defecation as well as a feces/ wash water blending and discharge cycle. It also features an adjustable urinal which is designed to collect urine while preventing spillage during micturition. Both the feces and urine collection techniques are designed for use in either a zero or one gravity environment. Overall reactions to the system by eight users were favorable. Author

N70-28066# Hawaii Univ., Honolulu. Dept. of Physics and Astronomy.
METHODOLOGIES OF PATTERN RECOGNITION Final Scientific Report
Satosi Watanabe Apr. 1969 480 p refs
(Grant AF-AFOSR-1379-68)
(AD-701524; AFOSR-70-0513TR) Avail: CFSTI CSCL 6/4

The book presents the papers that were given at a conference on methodologies of pattern recognition. The titles include: implications of interactive graphic computers for pattern recognition methodology; statistical analysis as a tool to make patterns emerge from data; descriptive pattern analysis techniques, potentialities and problems; sequential pattern recognition systems; biological and mechanical pattern recognition; the automatic classification of fingerprints; cluster formation at various perceptual levels; recognition, machine recognition and statistical approaches; pattern recognition applied to the counting of nerve fiber cross-sections and water droplets; recognition by imitating the process of pattern generation; and the evaluation of the statistical classifier. Author (TAB)

N70-28086# Washington Univ., Seattle. Dept. of Psychology.
PROBABILITY LEARNING: RESPONSE PROPORTIONS AND VERBAL ESTIMATES
Lee Roy Beach, Richard M. Rose, Yutaka Sayeki, James A. Wise, and William B. Carter 14 Feb. 1970 26 p refs
(Contract N00014-67-A-0103-0011)
(AD-701363; Rept-70-1-02) Avail: CFSTI CSCL 5/10

At various points in a two-choice probability learning experiment, Ss were interrupted and asked to estimate the probability of the most frequent of the two stimulus events. The Ss estimates were compared with the proportion of trials on which other Ss predicted the events. The estimates change as a function of training in a manner consistent with a simple Bayesian revision model. Author (TAB)

N70-28091*# General Electric Co., Philadelphia, Pa. Re-Entry and Environmental Systems Div.
BIOSATELLITE ENVIRONMENTAL CONTROL COOLANT LOOP SYSTEM DESIGN
Robert Ebersole 1970 18 p Presented at AFOSR Symp., Palo Alto, Calif., 21 Mar. 1970
(Contract NAS2-1900)
(NASA-CR-73401) Avail: CFSTI CSCL 06K

A functional description of the environmental control coolant loop system design is presented for the 30-day mission NASA Biosatellite program. A two-loop system is described which provides temperature control for the fuel cell power source, cryogenic subsystem, water and urine storage, and the gas management system. The latter provides control of the gaseous environment in the recovery vehicle. It controls temperature, relative humidity, recirculation and filtration of the atmosphere, build up of toxic and/or non-toxic gases and odors, and partial and total pressure of the standard 14.7 psi nitrogen/oxygen atmosphere. Comparison of experimental and flight results with analytical predictions are presented. Extensive thermal vacuum system testing was performed to verify design predictions; good agreement with analysis was achieved. Author

N70-28097# Texas Christian Univ., Fort Worth. Inst. for the Study of Cognitive Systems.
PYTHAGOREAN DISTANCE AND THE JUDGED SIMILARITY OF SCHEMATIC STIMULI Technical Memo
William C. Rankin, Robert P. Markley, and Selby H. Evans Dec. 1969 28 p refs
(Contract DAAD05-68-C-0176)
(AD-702250; HEL-TM-25-69) Avail: CFSTI CSCL 5/10

Independent groups of Ss rated the similarity of pairs of patterns belonging to the same class, either before or after a discrimination task of schematic concept formation (SCF). Average judged similarity is related to SCF pretraining. A linear relationship was investigated between a Pythagorean-distance measure on the patterns and subjective similarity of pairs of stimuli ($r = .88$). Pythagorean distance between pairs of patterns was measured by summing the squared differences between their corresponding physical attributes. A secondary analysis of the discrimination judgments in the SCF task indicated Pythagorean-distance measure as predictive of judgments on pairs of stimuli from the same schema family. Author (TAB)

N70-28107# Infoton Inc., Burlington, Mass.
ASPECTS OF STOCHASTIC PROCESS IDENTIFICATION USING WIENER CANONICAL FORMS Technical Report
Ernest G. Henrichon, Jr. Dec. 1969 22 p refs
(Contract AF 49(638)-1631)
(AD-702118; TR-19) Avail: CFSTI CSCL 9/4

The Wiener Canonical Expansion (WCE) procedure of Bayes decision rule is considered from a pattern recognition standpoint in the form of a phi machine. This approach provides some insight about the roles which the various stages and parameters of the expansion assume. Experiments conducted previously for speaker discrimination using the WCE procedure were reperformed in order to correct for a processing error. The conclusions of these revised experiments were the same as in the previous work: speaker identification was not realized with any degree of certainty by processing raw speaker data as if it were representative of some stationary random process. Author (TAB)

N70-28109# Texas Christian Univ., Fort Worth.
THE RANDOM ADAPTIVE MODULE RAM: A FORMAL SYSTEM FOR S-R MODELING WITH APPLICATIONS TO SCHEMA THEORY Technical Memo
Selby H. Evans Dec. 1969 27 p refs
(Contract DAAD05-68-C-0176)
(AD-702249; HEL-TM-24-69) Avail: CFSTI CSCL 6/4

A method of model construction is proposed to facilitate the achievement of relatively complex processes by combinations of basic stimulus-response (S-R) units. A basic process resembling stimulus-response learning is used to construct a model capable of learning to recognize and reproduce a pattern or schema. In the context of schema theory, this model is further developed to simulate the process of learning to distinguish one schema from another (schematic concept formation). Results of a computer simulation and comparison with human performance are reported; substantial correspondence is demonstrated between the human performance and that of the model. Author (TAB)

N70-28115*# Bell Aerosystems Co., Buffalo, N.Y.
ASTRONAUT MANEUVERING UNIT BRASSBOARD Final Report
Mar. 1970 48 p
(Contract NAS9-9368)
(NASA-CR-108462; SSD-206) Avail: CFSTI CSCL 06B

The configuration and operating characteristics are presented of a simple astronaut maneuvering unit brassboard, designed to evaluate the utility of a first generation maneuvering unit in accomplishing future EVA tasks. Initially, the scope of the program was for the development of a unit controlled in the acceleration command mode. This scope was subsequently revised to incorporate an acceleration/rate command system, with the mode of control selected by the operator. Author

N70-28157*# Southwest Research Inst., San Antonio, Tex.
DIGITAL THERMOMETER, PART 2 Final Report
Richard Lorenz and J. W. Fogwell Nov. 1969 21 p
(Contract NAS9-7852; SwRI Proj. 16-2327)
(NASA-CR-108423) Avail: CFSTI CSCL 06B

A prototype digital thermometer demonstrated accuracies of better than + or − 0.2 F for temperatures measured between 74 F and 115 F. The application of digital techniques allowed the use of integrated circuitry along with minimum power requirements

Direct temperature readout by means of incandescent displays provided precise information without requiring interpolation of scales. The digital technique allowed the use of miniature sensing devices which yielded rapid thermal-response times. Interchangeability of probe devices maintaining the desired accuracy was also accomplished. The digital thermometer was constructed as a prototype unit with primary effort devoted to the establishment of high accuracy. With this success in hand, the miniaturization and refined accuracy through rigorous calibrating techniques could now proceed. Author

N70-28158*# Southwest Research Inst., San Antonio, Tex.
METABOLIC RATE MEASUREMENT SYSTEM, PART 1 Final Report, Apr. 1968 - Nov. 1969
J. W. Fogwell, P. F. Law, V. R. Sturdivant, and R. B. Curtin Nov. 1969 46 p
(Contract NAS9-7852; SwRI Proj. 18-2327)
(NASA-CR-108422) Avail: CFSTI CSCL 06B

The Metabolic Rate Measurement System (MRMS) was conceived as an improved means of accomplishing rapid and accurate measurements of oxygen consumption, carbon dioxide generation, and total ventilation of a human subject during a one-minute interval. The MRMS is intended to replace the more cumbersome conventional methods of measuring these quantities, methods which require the use of several dissociated instruments and many cumbersome calculations. It combines all the necessary instruments and transducers into one equipment rack and includes a special purpose hybird computer to perform the necessary calculations. Author

N70-28163# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
A COMPARISON OF VOICE AND TONE WARNING SYSTEMS AS A FUNCTION OF TASK LOADING Technical Report, 10 Oct. 1968 - 10 Jan. 1969
Paul Kemmerling, Richard Geiselhart, David E. Thorburn, and James Gary Cronburg Sep. 1969 53 p
(AD-702459; ASD-TR-69-104) Avail: CFSTI CSCL 1/2

The study was designed to create a flight condition that would be sufficiently stressful, and at the same time, require the pilot to direct his attention out of the cockpit for relatively long periods, so that an adequate comparison could be made between voice and tone warning. Author (TAB)

N70-28184# Joint Publications Research Service, Washington, D.C.
COMPUTING THE MINIMUM NECESSARY VENTILATION VOLUME FOR INSULATING SUITS
V. V. Selivanov *In its* Space Biol. and Med., Vol. 4, No. 1 28 Apr. 1970 p 49 - 53 (See N70-28176 14-04)
Avail: CFSTI

A method for computing the ventilation volume of special suits is described. The dependence of the concentration of toxic contaminants on gas flow direction, location fo gas elimination sources and escape points and sites of concentration measurement is considered. Equations are derived for determining the ventilation volume; these are applied for single and mixed toxic impurities. A criterion is proposed for evaluating the effect of a nonstationary state of gas release on the concentration. Author

N70-28193# Joint Publications Research Service, Washington, D.C.
NATURE OF THE EEG FOR FLIERS (COMMUNICATION 1)
A. N. Litsov et al *In its* Space Biol. and Med., Vol. 4, No. 1 28 Apr. 1970 p 103 - 104 refs (See N70-28176 14-04)
Avail: CFSTI

Cerebral bioelectric activity in subjects at rest in a semireclining position was investigated. In 96% of air personnel, a well-expressed alpha rhythm was noted. In the other 4% the EEGs exhibited a predominance of rapid fluctuations. A high or moderate activity of the alpha rhythm was observed in most of the subjects. With a decrease in degree of the alpha rhythm there was a clearly expressed shift in e direction of predominating frequent EEG potentials and a decrease in slow waves. N.E.N.

N70-28236*# TRW, Inc., Cleveland, Ohio. Mechanical Products Div.
AIRCREW OXYGEN SYSTEM DEVELOPMENT: FLIGHT BREADBOARD SYSTEM. FLIGHT AND ENVIRONMENTAL TESTS
R. J. Kiraly, A. D. Babinsky, and J. D. Powell Apr. 1970 97 p
(Contract NAS2-4444)
(NASA-CR-73393; TRW-ER-7256-18) Avail: CFSTI CSCL 06K

The program objective is the development of a safe, reliable, compact system which would replace the LOX system currently in use, thereby minimizing logistics, service and facilities required. The Flight Breadboard System (FBS) used in the flight testing is the first packaging of the laboratory type components into a complete oxygen system allowing operation outside of the laboratory. The aircrew oxygen system, flight breadboard system, consists of four primary subsystems: 1) water electrolysis, 2) carbon dioxide concentrator, 3) rebreather and 4) electrical control. Major conclusions reached as a result of the flight and environmental test program are: 1) the objectives of the flight test program were successfully met; 2) the aircraft flight environment does not adversely affect system operation; 3) system operation, service and maintenance can be accomplished without laboratory support equipment; 4) the flight test program has successfully demonstrated the operation of an electrochemical aircrew oxygen system; 5) no limitations or design flows were found which would negate the concept of this system for further development; and 6) the system is not adversely affected by large variations in operating environment. Author

N70-28266# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
HUMAN ABILITY TO ESTIMATE TARGET LOCATIONS WITH RESPECT TO TWO POINTS Final Report, May 1968 - Mar. 1969
Nils M. Aume Nov. 1969 23 p refs
(AD-701389; AMRL-TR-69-44) Avail: CFSTI CSCL 5/5

Two coordinate systems, polar and rectangular, were compared in an experiment in which undergraduate students estimated the coordinates of a target on an unstructured map showing the target point and two reference points. The reference points were oriented either conventionally (i.e., horizontally or vertically) or randomly. Both gross errors (e.g., wrong quadrant) and inaccuracies, exclusive of gross errors, were analyzed. Author (TAB)

N70-28280# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio. Human Engineering Div.
THE EFFECT OF THE NUMBER OF ALLOWED TARGET CHOICES UPON THE TARGET-REPORTING BEHAVIOR OF RADAR OBSERVERS
Herschel C. Self and Almon J. Bate Nov. 1969 47 p refs
(AD-701382; AMRL-TR-69-96) Avail: CFSTI CSCL 15/7

Studies which impose no limit upon the number of responses an observer can make usually find high false-positive rates. The present study examines observer performance when limits are imposed. Forty-two bombardier-navigators were divided into three target choice groups: 20, 40, and no limit. They examined a moving strip of side-looking radar imagery rear-projected onto a 14 by 14-inch display screen. The displayed image covered a 25-mile wide strip of terrain, simulating a 1320-knot mission lasting 27 minutes. Author (TAB)

N70-28398# National Bureau of Standards, Washington, D.C.
A STATISTICAL STUDY OF PHYSICAL CLASSROOM EXPERIMENTS

John Mandel *In its* Precision Meas. and Calibration, Vol. 1 Feb. 1969 p 187-203 reprinted (See N70-28376 14-19)
Avail: SOD $5.50

An illustration of how the same set of data can be scrutinized on the basis of eight different assumed models is presented. The method of least squares for linear regression is used to show students that the general linear hypothesis is an elegant and powerful tool for answering fundamental questions. The data are also analyzed with a control chart type of analysis to obtain information about the results of each individual student. It is felt that the experiment provides an opportunity for discussing the relationship between experimental design and analysis. N.E.N.

N70-28458# General Electric Co., Daytona Beach, Fla. Apollo Systems Dept.
STUDY FOR APPLYING COMPUTER-GENERATED IMAGES TO VISUAL SIMULATION Final Report, Jan. Jul. 1969
Robert A. Schumacker, Brigitta Brand, Maurice Gilliland, and Werner H. Sharp Sep. 1969 146 p refs
(Contract F33615-69-C-1280)
(AD-700375; AFHRL-TR-69-14) Avail: CFSTI CSCL 5/9

The report describes the results of a system design study for applying digital image generation techniques to visual simulation for pilot training. The computer generated images are to provide out-the-window scenes for a flight simulator which is to be used for training Air Force pilots. No existing visual system can provide all of the capabilities which are desired in a flight simulator. Digitally generated scenes do overcome many of the shortcomings associated with more conventional approaches but have had limited application because of the difficulty of computing enough image detail. The ability to generate images of more complex and realistic environments is closely tied to advances in digital device technology. The study assesses the impact of recent developments in this area on the design of an image generating system. The conceptual design of an image generator is described. The principles of operation, the system configuration and operational characteristics are discussed. Several key problem areas are explored in depth. Feasible methods of implementation with presently available hardware are examined and an estimate of the hardware complexity is given. Author (TAB)

N70-28478# Advisory Group for Aerospace Research and Development, Paris (France).
HUMAN FACTORS IN THE GROUND CONTROL OF AIRCRAFT
V. David Hopkin (RAF Inst. of Aviation Med., Farnborough, Engl.) Apr. 1970 183 p refs
(AGARDograph-142; AGARD-AG-142-70) Avail: CFSTI

The actual and potential contributions of human factors to the smooth and efficient functioning of systems for the ground control of aircraft are described and discussed. These systems are concerned with air traffic control or air defence, which fulfill different roles but share many human factors problems. The nature of the human factors contribution at each stage in the evolution of a ground control system is described. Much work has dealt with displays, controls, or communications, or with man's role in complex man machine systems. Individual differences are considered in relation to selection, training, and screening procedures, and some of the differences which appear most relevant in systems are discussed. Both traditional and new methods for measuring operators are examined in terms of their merits and limitations. The factors of potential relevance to task performance are very numerous, and certain advances in other applied or academic contexts may be adapted with profit to ground control systems. Many of the proposed solutions to human factors problems have been based on limited evidence, mainly because man is treated primarily as a system component. Some probable future trends in the application of human factors to ground control systems are suggested. Author

N70-28501*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
PORTABLE LIFE SUPPORT SYSTEMS Conference Papers
Washington 1970 380 p refs Conf. held at Moffett Field, Calif., 30 Apr.-2 May 1969
(NASA-SP-234) Avail: CFSTI CSCL 06K

Papers are presented on portable life support systems for terrestrial, underwater, and aerospace application. Protective suits, heating and cooling systems, oxygen supply, and carbon dioxide removal are stressed. For individual titles see N70-28501 through N70-28525.

N70-28502*# National Aeronautics and Space Administration, Washington, D.C.
ADVANCED PORTABLE LIFE SUPPORT SYSTEMS: THE KEY TO INDEPENDENT OPERATIONS Keynote Address
Walton L. Jones *In its* Portable Life Support Systems 1970 p 1-3 (See N70-28501 14-05)
Avail: CFSTI CSCL 06K

Introductory remarks are given on life support systems for hostile environments. The need for space technology utilization in the nation's economy is mentioned. Reliability is identified as the basic requirement, but with two- and three-year missions, maintainability, weight, volume, and power considerations also become major constraints. It is felt that the correct balance between theory and experiment has not yet been achieved in the area of advanced portable life support, and the university can help in developing more concepts and in training more people in this field. N.E.N.

N70-28503*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
PHYSIOLOGICAL SPECIFICATIONS FOR PERSONAL LIFE SUPPORT SYSTEMS
John Billingham *In its* Portable Life Support Systems 1970 p 5-10 refs (See N70-28501 14-05)
Avail: CFSTI CSCL 06K

The problems encountered in preparing physiological and environmental design specifications are outlined. In chosing between physiological and environmental specifications, it is recommended that preference be given to quantities that are the least complicated, least ambiguous, and easiest to measure. The specification should be supplemented by a variety of data to assist in translating requirements into hardware. The acceptability of factors for controlling parameters within allowable limits should be included. In the event that the optimum environment is not attainable, penalties must be stated for human performance reduction; mortality probability; development of chronic pathological conditions; intensity, duration, rates of change of application, and other characteristics of stresses; the mean probability that one of three failure modes will occur; and the curve describing the variability about this point. Specifications are given for inspired gas partial pressures, total pressure, metabolic rate, and thermal condition. N.E.N.

N70-28504*# Hamilton Standard, Windsor Locks, Conn.
INTEGRATED MANEUVERING AND LIFE SUPPORT SYSTEM
Thomas W. Herrala, Douglas C. Howard, and Philip F. Heimlich *In* NASA. Ames Res. Center Portable Life Support Systems 1970 p 11-27 (See N70-28501 14-05)
(Contract F33615-67-C-1946)
(AMRL-TR-69-41) Avail: CFSTI CSCL 06K

Descriptions are presented of the protective suit, life support system, and maneuvering unit which are combined into one system providing increased EVA capability. All the hardware is wrapped around the crewman in such a way that the center of gravity of the complete system with man is approximately the same as that of the man alone. It provides powered translational and rotational maneuvering capability in six degrees of freedom. The suit portion consists of a two-piece hard torso, soft arms and legs, and helmet. The life support system contains pressure supply and control,

atmosphere revitalization, and thermal control. The maneuvering unit consists of a hand control assembly, thrust control assembly, and propellant tank module. N.E.N.

N70-28505*# Naval Ordnance Station, Indian Head, Md. Explosive Disposal Facility.

MODULAR TOXIC ENVIRONMENT PROTECTIVE SUIT

E. J. George and A. H. Klein *In* NASA. Ames Res. Center Portable Life Support Systems 1970 p 29-39 (See N70-28501 14-05)

Avail: CFSTI CSCL 06Q

The MODTEPS is a life support system designed to be used in highly toxic environs by technicians engaged in explosive ordnance disposal work and for special munitions handling. The suit provides complete protection to the wearer from chemical and biological agents, as well as from contamination by radioactive materials. The suit is used with one of three air supply systems: (1) cryogenic, (2) compressed air, or (3) filtered air. The cryogenic backpack provides up to four hours of life support while also providing air conditioning to the wearer. The compressed air, either from bottles or a portable compressor, provides breathing air and, using a vortex discrimination effect, also provides cooling or heating. The filter system, always present as a backup, is two M-17 gas mask filters mounted in the back of the helmet. Details of the development and system components are given. Author

N70-28506*# AiResearch Mfg. Co., Los Angeles, Calif. Space Environmental Systems.

DEVELOPMENT OF THE PORTABLE ENVIRONMENTAL CONTROL SYSTEM

R. Norman Prince (NASA. Manned Space Craft Center, Houston, Tex.), Thomas L. Iles, and William J. O'Reilly *In* NASA. Ames Res. Center Portable Life Support Systems 1970 p 41-58 (See N70-28501 14-05)

Avail: CFSTI CSCL 06K

The system selection and prototype development of the control system for AAP earth orbital and extended lunar applications are described. Three types of prototype systems were identified: semiclosed, closed, and a chemical system which absorbs carbon dioxide and generates oxygen. Comparison data are tabulated. The components of the prequalification prototype are also described. It contains a water loop for heat rejection and an oxygen loop for respiration, suit pressurization, and carbon dioxide and humidity control. The noteworthy features are identified as (1) an integrated fan, pump, and photoelectrically commutated dc motor; (2) magnetic coupling of the pump to the fan motor; (3) redundant pump and motor; (4) ejector pump backup to fan; and (5) liquid-to-liquid heat exchanger for pre- and post-EVA operations within a pressurized cabin. N.E.N.

N70-28507*# Navy Experimental Diving Unit, Washington, D.C.

SEMICLOSED AND CLOSED CIRCUIT UNDERWATER BREATHING APPARATUS

William I. Milwee, Jr. *In* NASA. Ames Res. Center Portable Life Support Systems 1970 p 59-71 refs (See N70-28501 14-05)

Avail: CFSTI CSCL 06K

The design of Mark 9, an umbilical supplied semiclosed circuit mixed gas underwater breathing apparatus, is described. The semiclosed circuit represents a practical compromise between the need for increased depth and duration of dive, the size and complexity of the breathing apparatus, and diver safety. Its advantages are identified as the following: (1) Gas utilization is high. (2) Semiclosed systems are relatively simple and are purely mechanical. (3) There has been a wealth of experience with semiclosed systems. The system is also compact and weighs only 50 lb. The components and operation of the system are described. N.E.N.

N70-28508*# Army Natick Labs., Mass.

MICROCLIMATE-CONTROLLED (THERMALIBRIUM) PROTECTIVE CLOTHING SYSTEM FOR MILITARY APPLICATIONS

Leo A. Spano *In* NASA. Ames Res. Center Portable Life Support Systems 1970 p 73-85 (See N70-28501 14-05)

Avail: CFSTI CSCL 06Q

Microclimate-controlled clothing to protect troops against a multitude of potential hazards was developed. In thermalibrium clothing, heat regulation is achieved by circulation of heated, ambient, or conditioned air inside the clothing. The total system consists of three major components: a combined protective helmet; the body clothing with appropriate shoes and gloves; and a lightweight, self-powered, heat regulation device that can be integrated with the clothing or a heat regulation device that is powered remotely from a vehicle. The insulation property is such that if the heat regulation device fails in extreme cold, the individual will not become a cold weather casualty. This combined protective ensemble provides complete protection against CW and BW agents and prevents radioactive fallout from coming into direct contact with the skin or respiratory tract. It also affords protection against thermal radiation to the level required and protection against natural hazards. The individual wearing this ensemble should be able to perform duties effectively at temperatures as low as -40 F and as high as +110 F. Author

N70-28509*# TRW Systems, Redondo Beach, Calif. Electrochemical Products Dept.

NASA AIRCREW OXYGEN SYSTEM

P. D. Quattrone (NASA. Ames Res. Center), A. D. Babinsky, R. J. Kiraly, F. H. Shubert, R. K. Mitchiner et al *In* NASA. Ames Res. Center Portable Life Support Systems 1970 p 87-113 refs (See N70-28501 14-05)

(Contract NAS2-4444)

Avail: CFSTI CSCL 06K

An advanced aircrew oxygen system is being developed to replace the currently used LOX aircrew breathing systems. This new system is designed to increase flight mission durations, to eliminate the safety hazards associated with the LOX systems, and to have minimal ground servicing requirements that decrease costs. The system is a closed-loop system and includes: a water electrolysis module for generating oxygen; a rebreather loop that includes an electrochemical carbon dioxide scrubber, a nitrogen elimination vent, humidity control, and thermal control. Results are reported on the water electrolysis module, carbon dioxide concentrator module, power conversion and conditioning, laboratory breadboard system, flight breadboard system, and aircrew oxygen system. Author

N70-28510*# Naval Facilities Engineering Command, Falls Church, Va.

RADIOISOTOPE HEATED SWIMSUIT

Glenn W. Zimmer *In* NASA. Ames Res. Center Portable Life Support Systems 1970 p 115-126 (See N70-28501 14-05)

Avail: CFSTI CSCL 06K

Problems and solutions in the development of the swimsuit for Sealab 3 are briefly described. The problem areas include the location and shielding of the isotope, effects of increased oxygen pressure on radiosensitivity of body cells, and dose rates and dose limits. Monitoring and emergency systems are also outlined. N.E.N.

N70-28511*# Litton Systems, Inc., Beverly Hills, Calif. Space Sciences Center.

LITTON PORTABLE LIFE SUPPORT SYSTEM

Daniel L. Curtis *In* NASA. Ames Res. Center Portable Life Support Systems 1970 p 127-137 (See N70-28501 14-05)

Avail: CFSTI CSCL 06K

A prototype portable life support system is described which represents a reduction in weight and volume. It is felt that the most important advancement is a breathing vest worn over the liquid coolant garment. A volume change in the lungs is reflected by an equal volume change in the vest, causing a corresponding

volume of oxygen to be delivered to the oral/nasal region, and reducing the oxygen flow requirements. The essential features are considered to be an open loop gas flow, a gas-operated pump for circulating coolant water, a lightweight nonclogging sublimator for cooling, and a chest-mounted control unit for gas and temperature. The system does not depend on electrical power for primary life support. N.E.N.

N70-28512*# Naval Air Development Center, Johnsville, Pa. Life Sciences Research Group.
DESCRIPTION AND EVALUATION OF A PORTABLE DRY-ICE WATER-CONDITIONED SUIT SYSTEM FOR AIR CREWMEN
John J. Esposito *In* NASA. Ames Res. Center Portable Life Support Systems 1970 p 139 149 refs (See N70-28501 14-05)
Avail: CFSTI CSCL 06K

The water cooling system using dry ice as the refrigerant is described and test results are described. Subjects wearing liquid-cooled suits were exposed to ambient temperatures of 105 F and 115 F, with and without the portable cooling system in operation, and rectal and skin temperatures were monitored. It is felt that the dry-ice cooler system is effective and has the advantages of minimized weight, maintenance, and power consumption. N.E.N.

N70-28513*# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
EFFICACY OF VENTILATING SYSTEMS
James H. Veghte *In* NASA. Ames Res. Center Portable Life Support Systems 1970 p 151 158 refs (See N70-28501 14-05)
(AMRL-TR-69-54) Avail: CFSTI CSCL 06Q

Several air-cooled systems and one water-cooled system worn under flight clothing were evaluated. The subjects were exposed to an environment of 43 C/45 mm Hg water vapor pressure at sea level. Sweat loss, body temperature, and heart rate measurements were taken. All systems were found to ameliorate discomfort, with the water-cooled system showing slight enhancement over air systems. Provisions for cooling the face decreased discomfort. Optimal ventilating systems are proposed for permeable and impermeable clothing. N.E.N.

N70-28514*# Webb Associates, Yellow Springs, Ohio.
AUTOMATIC COOLING: STRATEGIES, DESIGNS, AND EVALUATIONS
Paul Webb *In* NASA. Ames Res. Center Portable Life Support Systems 1970 p 159 177 refs (See N70-28501 14-05)
Avail: CFSTI CSCL 06K

As a basis for evaluating the various control approaches, the physiology of a man in a water-cooled suit was defined in a study of metabolic time constants; the subject was thermally isolated and kept biothermally neutral at rest and during work. The characteristic responses studied were oxygen consumption, heart rate, skin temperature, rectal temperature, and rate of heat removal. This study resulted in a biothermal model that was useful as an analytical tool and as a means of testing control approaches during simulation runs. The biothermal model is updated and improved continually; it was found recently, for example, that muscle temperatures are lower during work with cooling than the standard values given in the literature. The metabolic time constants provided a basis for evaluating various control approaches. The first and simplest of these was an open loop controller using oxygen consumption as an input, from which was generated an exponential change in cooling rate with the proper time constant. The second control approach employed as inputs rate of heat removal and skin temperature, the skin temperature representing a feedback that added stability and improved control behavior during long quiet periods of low activity. Author

N70-28515*# Honeywell, Inc., St. Paul, Minn. Systems and Research Center.
FLUIDIC TEMPERATURE CONTROL FOR LIQUID-COOLED SPACE SUITS
J. B. Starr *In* NASA. Ames Res. Center Portable Life Support Systems 1970 p 179 189 refs (See N70-28501 14-05)
Avail: CFSTI CSCL 06K

An approach to coolant inlet temperature modulation with a liquid temperature controller in the spacecraft is described. With such a system, signals calling for coolant temperature modulations are transmitted by some means from the astronaut via the umbilical to the controller. The system is based on the use of the already existing supply and return conduits to transmit the control signals. Control signals are produced by varying the flow resistance across the liquid-cooled garment. These variations can be produced manually by the astronaut by turning a valve, or automatically by skin temperature sensors. Fluidic techniques are employed in the coolant temperature controller because of inherent reliability (no moving parts are required) and because of the low signal thresholds that are characteristic of fluidic devices. Author

N70-28516*# TRW Systems Group, Redondo Beach, Calif. Environmental Control and Life Support.
TECHNIQUES FOR EXCESS METABOLIC HEAT REJECTION FROM THE OUTSIDE SURFACES OF PROTECTIVE SUITS
A. P. Schlosinger *In* NASA. Ames Res. Center Portable Life Support Systems 1970 p 191 209 refs (See N70-28501 14-05)
(Contract NAS2-3817)
Avail: CFSTI CSCL 06K

The variable thermal conductance space suit shell concept and component subsystems are briefly summarized. The system uses controllable heat pipes to bypass a thermal insulation layer, flexible heat pipes for transmission of heat from the skin of an astronaut to the interior surface of a hard shell space suit, and heat pipes for temperature equalization in the external surface of the space suit. Author

N70-28517*# Naval Air Development Center, Johnsville, Pa. Aerospace Cren Equipment Dept.
PHYSIOLOGICAL EFFECTS OF WATER COOLING UNDER DIFFERENT ENVIRONMENTAL CONDITIONS
Louis J. Santa Maria *In* NASA. Ames Res. Center Portable Life Support Systems 1970 p 211 220 refs (See N70-28501 14-05)
Avail: CFSTI CSCL 06S

The effects of water cooling were studied in subjects at rest and performing mild work, in subjects wearing full pressure suits and performing extreme work, in subjects at rest wearing an automatically controlled system, and in sedentary subjects wearing portable water-cooled devices. To attain a level of constancy in the suit-subject relationship, the cooling suit was carefully taped close to the body in circumferential areas such as the torso, arms, and legs. While the results generally indicate the thermal advantages of the water-cooled system under the conditions described, there is a potential problem following the characteristic rise in rectal temperature and the continuous drop in overall skin temperature, observed especially during peak metabolic loads. Author

N70-28518*# Martin-Marietta Corp., Denver, Colo.
PORTABLE HEAT REJECTION SYSTEMS FOR THE EXTRAVEHICULAR ASTRONAUT
J. Travis Brown (NASA. Manned Spacecraft Center, Houston, Tex.) and Donald A. Myers *In* NASA. Ames Res. Center Portable Life Support Systems 1970 p 221 255 refs (See N70-28501 14-05)
(Contract NAS9-8184)
Avail: CFSTI CSCL 06K

Promising heat rejection systems were identified and compared with respect to various types of EVA missions as well as on

individual system merit. Nine systems consisted of a liquid-cooled garment, a heat transport loop, and one of the following sinks: wick-fed evaporator, forced-vortex boiling evaporator, porous-plate sublimator, gelled-water sublimator, heat of fusion of ice, heat of fusion of eutectic salts, recoverable water evaporant, recoverable ammonia evaporant, and space radiators. The systems not requiring a garment or loop were integral diffusion vaporization and integral heat pipes/suit radiator. It is concluded that the selection of heat rejection systems for next-generation PLSS must be tempered by considerations of safety, reliability, inflight maintainability, crew time lines for servicing, potential failure modes, spacecraft interfaces, probable impact of the system on the astronaut's center of mass, and development risk. The volume on the man and the total launch weight were overriding considerations in evaluating the parametric analyses. Author

N70-28519*# McDonnell-Douglas Astronautics Co., Santa Monica, Calif. Advanced Biotechnology and Power Dept.

ECGS LIQUID-PHASE-CHANGE GARMENT COOLING SYSTEM

J. G. Bitterly *In* NASA. Ames Res. Center Portable Life Support Systems 1970 p 257-277 refs (See N70-28501 14-05)
(Contract NAS9-7207)
Avail: CFSTI CSCL 06K

The evaporative cooling garment system (ECGS) which is integrated into an Apollo space suit is described. This garment provides heat exchange from the skin directly to space by means of 12 cooling segments, each utilizing the principle of liquid-phase-change of water within its structure. The cold steam generated in the segments at near-vacuum pressure is exhausted through a control directly to space. The system was demonstrated conclusively on the treadmill during 4-hr continuous simulated EVA missions. Work loads varied from resting periods up to sustained metabolic levels of 5000 Btu/hr (1260 kcal/hr). Cooling rates can be established instantly at any level with a fine control. This self-contained system has only one moving part, a valve that requires no power in manual control operation. The ECGS is a next-to-the-skin, highly flexible garment that functions as a body conductive heat sink; it provides high heat transfer with quantitative, controllable precision. Its application can greatly enhance the normal rate of heat loss at the skin surface. Any preselected cooling rates can be immediately established and maintained. The degree to which the skin capillary bed can meet this imposed cooling heat transfer is rate limited only by the efficiency of the vascular supply. Author

N70-28520*# Aerojet-General Corp., Azusa, Calif.

SOLID OXYGEN FOR PORTABLE LIFE SUPPORT SYSTEMS IN SPACE

John E. Ahern *In* NASA. Ames Res. Center Portable Life Support Systems 1970 p 279-290 refs (See N70-28501 14-05)
(Contract F33615-67-C-1849)
(AMRL-TR-68-105) Avail: CFSTI CSCL 06K

Oxygen storage and conversion systems are discussed. Oxygen stored in the solidified condition at the beginning of a mission will provide a longer storage life than that stored in the subcritical or supercritical liquid condition, provided that advantage is taken of the greater density, sensible heats, and heats of fusion of the solid material. Oxygen stored as a solid has advantages where continuous supply is not required; it would have advantages as a reserve or emergency supply as well as for EVA or lunar exploration where intermittent supply is required. Conversion of solid oxygen from the storage vessel into a breathable condition, as well as transport from one vessel to another, can best be done by manual transfer of solid blocks through an air lock device. Although oxygen can be converted from a solid to a breathable state by means of cryosorption pumps, certain characteristics of the test system indicated problems in widespread application of this system. Author

N70-28521*# AiResearch Mfg. Co., Los Angeles, Calif. Space and Applied Systems.

RESEARCH ON SODIUM CHLORATE CANDLES FOR THE STORAGE AND SUPPLY OF OXYGEN FOR SPACE EXPLORATION

Jack Littman and R. Norman Prince (NASA. Manned Spacecraft Center, Houston, Tex.) *In* NASA. Ames Res. Center Portable Life Support Systems 1970 p 291-330 refs (See N70-28501 14-05)
Avail: CFSTI CSCL 06K

Chlorate candle research and development programs are reviewed. Analytic methods are described, and mechanisms are suggested for the unwanted chlorine production. Sodium chlorate decomposition reactions are given and catalysis of the reaction is discussed. Fabrication techniques, purity analyses, and candle performance are described. Igniter research and development are also included. It is felt that definite advances in oxygen candle technology have been made, and potential applications are identified as space emergency oxygen supply, spacecraft rapid repressurization, filling of high pressure gas bottles, and supply of oxygen to portable environmental control systems. N.E.N.

N70-28522*# General Dynamics Corp., Groton, Conn. Electric Boat Div.

THE ROLE OF ACTIVE CHEMICALS FOR AIR REVITALIZATION

A. W. Petrocelli and H. Wallman *In* NASA. Ames Res. Center Portable Life Support Systems 1970 p 331-341 refs (See N70-28501 14-05)
Avail: CFSTI CSCL 06K

The use of metal superoxides, ozonides, and peroxides for oxygen supply and carbon oxide removal is discussed. The availability and air revitalization chemistry of the chemicals are described. Methods of air revitalization which were tested are the following: forced airflow through a fixed, granular bed of active chemicals; forced airflow through freshly ground powder; and reaction of the solid chemical with water followed by carbon dioxide absorption with the resulting alkaline solution. It is concluded that the chemistry of sodium and potassium superoxides is sufficiently developed to allow their application in air revitalization systems. N.E.N.

N70-28523*# Hamilton Standard, Windsor Locks, Conn.

LITHIUM PEROXIDE FOR PORTABLE LIFE SUPPORT SYSTEM ATMOSPHERIC REGENERATION

Kenneth J. Dresser and R. Norman Prince (NASA. Manned Spacecraft Center, Houston, Tex.) *In* NASA. Ames Res. Center Portable Life Support Systems 1970 p 343-371 refs (See N70-28501 14-05)
(Contract NAS9-8159)
Avail: CFSTI CSCL 06K

A test program was conducted to evaluate the capabilities of lithium peroxide to control carbon dioxide and supply oxygen for a PLSS, with the crewman's average metabolic rate at 2000 Btu/hr for 4 hr. It is demonstrated that lithium peroxide has excellent potential for development. The present system size is smaller than the nearest contender. The low-bulk-density granules, catalyzed with 2% nickel sulfate, gave the best overall performance. Thermal decomposition of the chemical enhances the oxygen evolution yield but deters carbon dioxide removal by producing lithium oxide, which is too dense to efficiently remove carbon dioxide, and by heating the lithium hydroxide monohydrate above its temperature for stable operation. The most significant parameter for lithium peroxide operation is bed temperature. Author

N70-28524*# General Electric Co., Philadelphia, Pa. Missile and Space Div.

A MEMBRANE SYSTEM FOR CARBON DIOXIDE CONTROL IN LIFE SUPPORT SYSTEMS

W. J. Ward, III *In* NASA. Ames Res. Center Portable Life

Support Systems 1970 p 373-378 refs (See N70-28501 14-05)
Avail: CFSTI CSCL 06K

The development of immobilized water membrane for carbon dioxide/oxygen separation is described. Porous cellulose acetate films impregnated with a saturated cesium bicarbonate solution containing 0.5M sodium arsenite were used. The effect of the sodium arsenite was to increase the carbon dioxide permeability by a factor of 3. The major disadvantage of the system is identified as the requirement that the humidity of the entering gases must be controlled. The major advantage is considered to be that it requires no replacement or regeneration of any components. N.E.N.

N70-28525*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
REGENERABLE SORBERS AND PORTABLE LIFE SUPPORT
Rex B. Martin *In its* Portable Life Support Systems 1970 p 379-389 refs (See N70-28501 14-05)
Avail: CFSTI CSCL 06K

Carbon dioxide sorbers are discussed. Development of the molecular sieve regenerable sorber and a method for analyzing it are described. Ion exchange resins were also investigated, and weak base amine resins showed the greatest promise. N.E.N.

N70-28644# Joint Publications Research Service, Washington, D.C.
DECIPHERING AUTOMATA IN THE ABSENCE OF AN UPPER BOUND OF THE STATE NUMBER
Ya. M. Barzdin 21 Apr. 1970 8 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (USSR), v. 190, no. 5, 1970 p 1048-1051
(JPRS-50356) Avail: CFSTI

Automata are defined as finite initial Mealy automata with given numbered states. All the automata are assumed to have the same input and output alphabets. An automation with an initial state is given about the internal structure of which nothing is known, including the upper bound of the state number, and such an automation is called a black box. Although no experiment is possible by which a black box can be deciphered, a multiple experiment does exist which permits deciphering the majority of black boxes. An analogous result is derived for the case of simple experiments and the length of the corresponding simple experiments is estimated. A deciphering algorithm over the black box is derived from which a corresponding algorithm is constructed to describe the behavior of the black box. R.B.

N70-28670*# National Aeronautics and Space Administration, Washington, D.C.
ADVANCEMENTS IN TELEOPERATOR SYSTEMS An AEC-NASA Technology Utilization Publication
1970 242 p Presented at a colloq., Denver, 26-27 Feb. 1969
(NASA-SP-5081) Avail: CFSTI CSCL 05H

Advances in computers, television, and electronic and mechanical devices which have contributed to the widespread use of the teleoperator are discussed. Emphasis is placed on transfer and teleoperator device technology to medical, aeronautical, and industrial fields. S.S.

N70-28680# Federal Aviation Administration, Washington, D.C. Office of Aviation Medicine.
FIDELITY OF SIMULATION AND TRANSFER OF TRAINING: A REVIEW OF THE PROBLEM
Siegfried J. Gerathewohl Dec. 1969 21 p refs
(FAA-AM-69-24) Avail: CFSTI

There are several kinds of flight simulators available today which are valuable tools for research, training and proficiency determination. They range from simple trainer type devices, which are useful for the learning of specific tasks, to very sophisticated ground based facilities and aircraft used for crew training under simulated environmental and operational conditions. The various perceptual phenomena and performance modes observed indicate that it is not physical similarity of the devices but psychologic, physiologic, and operational realism which determine fidelity in simulation. The amount of transfer of training appears to be closely related to the degree of fidelity which can be provided. Author

N70-28751*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
TECHNICAL FEASIBILITY DEMONSTRATION MODEL OF ORBITING EXPERIMENT FOR STUDY OF EXTENDED WEIGHTLESSNESS
J. M. Smith, P. B. Maine et al 11 May 1970 174 p refs
(Contract NAS1-8200)
(NASA-CR-66934) Avail: CFSTI CSCL 06B

The design, fabrication, and testing of a Technical Feasibility Demonstration Model (TFDM) of a one-primate configuration of the Orbiting Primate Experiment hardware is summarized. The TFDM has provisions for supporting a 6 kg rhesus monkey in an unrestrained fashion for a period of one year. Subsystems include: feeder, waterer, waste management, air circulation, temperature control, TV and illumination, behavioral programmer and associated task equipment, biotelemetry of ECG and temperature, detection of primate activity and vocalizations, primate mass measurement, and automatic primate retrieval at experiment conclusion. Among the tests reported are feeder vibration, accelerated one-year life testing of the feeder and waterer and acceptance tests, and a 56-day primate test. Author

N70-28817*# Pittsburgh Univ., Pa. Space Research Coordination Center.
TWO SURVEYS OF THE NEEDS OF ENGINEERING SCHOOLS IN THE FIELD OF BIOMECHANICAL AND HUMAN FACTORS ENGINEERING EDUCATION
Erwin R. Tichauer (New York Univ.) and Alan A. Glaser 14 Apr. 1970 38 p refs
(Grant NGL-39-011-002)
(NASA-CR-110201; SRCC-124) Avail: CFSTI CSCL 06B

Several excellent surveys about the state of the art of bioengineering, biomechanics, and biomechanical and human factors engineering at American universities and colleges already exist. This report endeavors to complement and supplement the aforementioned two strands of inquiries with the opinion of engineering educators about the needs to train, in sufficient numbers, badly needed professionals for the practice of this fast developing discipline. While the purpose of the two surveys was to obtain information on biomechanical and human factors engineering education in particular, the results are of interest and apply to most areas of biotechnology. Author

N70-28856# Kernforschungsanlage, Juelich (West Germany). Zentralabteilung Strahlenschutz.
EXPERIENCE IN PRACTICAL RADIATION PROTECTION WITH THERMOLUMINESCENCE DOSIMETERS FOR THE DETERMINATION OF THE DOSAGE OF PARTIAL RADIATIONS [ERFAHRUNGEN IM PRAKTISCHEN STRAHLENSCHUTZ MIT THERMOLUMINESZENZDOSIMETERN ZUR BESTIMMUNG DER DOSIS BEI TEILBESTRAHLUNGEN]
M. Heinzelmann Feb. 1970 22 p refs In GERMAN
(JUEL-640-ST) Avail: CFSTI

The experience after one year and the results of partial particle dosage determination with thermoluminescence dosimeters are discussed. The results are compared with those from dosimeter films, worn as bracelets, and finger rings. The comparison shows that the film dosimeters are not suitable for determining the maximum values of the dosages received on hands. Author (ESRO)

N70-29085# Royal Aircraft Establishment, Farnborough (England) Engineering Physics Dept.

AN ANTHROPOMETRIC SURVEY OF 200 RAF AND RN AIRCREW AND THE APPLICATION OF THE DATA TO FARMENT SIZE ROLLS

R. E. Simpson and C. B. Bolton 1970 93 p refs Supersedes RAE-TR-67125; ARC-30918

(ARC-R/M-3612; RAE-TR-67125; ARC-30918) Copyright. Avail: CFSTI; HMSO: £ 2 8s; BIS $8.65

An anthropometric survey of limited scope was undertaken in October and November 1966, involving 200 Royal Air Force and Royal Navy aircrew. The 44 measurements taken on each subject were mainly those used in the drafting of patterns for the RAF experimental range of aircrew functional garments. The acquired data was tabulated and presented in a form primarily suitable for functional clothing purposes. Tables and graphs are also included which give the data in a form suitable for use in aircrew work-space studies etc. Comparisons are made between specimen garment size-rolls for the 200 subjects based on the chest girth/torso hoop, chest girth/stature, and weight/stature as control parameters. Analysis of the data supports the recommendation that size-rolls for one-piece garments in which a good torso fit is essential should be based on two direct body measurements, such as chest girth and torso hoop, rather than include one or more indirect measurements like weight or stature in the control parameters. The data indicate that if one-piece garment torso fit is not important, it is better logistically to use chest girth/stature of weight/stature as controls for garment sizing. From the experience gained during this survey, suggestions are made regarding measuring techniques and procedures which should prove useful in a larger scale survey which is recommended. Author (ESRO)

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N70-27807# Naval Research Lab., Washington, D.C. Plasma Physics Div.

MEASUREMENT OF NITROGEN II AND CARBON II RESONANCE MULTIPLET LINE SHAPES FROM A PLASMA Final Report

John D. E. Fortna 31 Dec. 1969 83 p refs

31 Dec. 1969 83 p refs

(AD-702393; NRL-6950) Avail: CFSTI CSCL 7/4

The spectral line shapes of the Nitrogen II and Carbon II resonance multiplets, which occur in the vacuum ultraviolet region of the spectrum, have been measured. The Stark widths were deduced from the optically thin Lorentz wings. The source of radiation was a hot plasma produced by reflecting the shock wave generated by an electromagnetic T-type shock tube operating at a moderate pressure of helium gas to which the test elements (and hydrogen) were added. The electron temperature was determined from the ratio of the total intensities of the He I 4713 A and the H beta 4861 A lines. The electron density was obtained from the halfwidth of the He I 3889 A line. Measurement of the electron temperature and density of the test plasma was such as to provide a critical test of a recent semiempirical theory of Stark broadening of isolated ion lines under conditions in which the broadening electron collisions are predominantly elastic and without classical analogue. Agreement with the theory was found to within the expected precision of the theory. Author (TAB)

N70-27827# Massachusetts Univ., Amherst. Polymer Research Inst.

EFFECT OF OPTICAL ROTATION ON LOW-ANGLE LIGHT SCATTERING PATTERNS

C. Picot and R. S. Stein Dec. 1969 27 p refs

(Contract Nonr-1357(01))

(AD-700942; ONR-TR-123) Avail: CFSTI CSCL 7/4

The effect of optical rotation of the environment is calculated for the H(V) and V(V) low-angle light scattering patterns of two-dimensional spherulites. As with the effect of birefringence, the change in the H(V) pattern is greater than that on the V(V). With increasing optical rotation contribution, the patterns lose their characteristic shape and become more circular. Author (TAB)

N70-27828# Naval Radiological Defense Lab., San Francisco, Calif.

THE SYNERGISTIC EFFECT OF BENZHYDRYLATION IODINATION ON THE FLAMMABILITY OF ALPHA-CELLULOSE Final Report

Anne E. Lipska May 1969 31 p refs

(Contract DAHC20-67-C-0149)

(AD-701959) Avail: CFSTI CSCL 7/4

Cellulose samples were subjected to various degrees of iodination, benzhydrylation and benzhydrylation followed by iodination. The effect of these treatments on crystallinity, rate of thermal degradation, char production and pyrolysis products was investigated. Results indicated that in general the crystallinity index varies inversely with the percent of substitution, rate of weight loss, and amount of residual char. Although the rates of weight loss of the substituted samples increased from 0.3%/min. to as high as 108%/min. depending on the type and percent of substitution, the overall weight loss pattern of the treated cellulose was similar to that of the untreated samples. Of the three types of retardants tried, iodine was the best flame retardant in that the residual char increased by a much larger factor for a given increase in rate. The addition of benzhydryl to the iodinated sample seemed to decrease rather than increase the char producing ability. All three treatments drastically reduce the number of degradation products of molecular weights lower than 150; untreated cellulose gave 59 components whereas the substituted cellulose led to five major compounds; water, acetic acid, furfural, 5 methyl-2-furfuraldehyde, and 1,5 anhydro-2, 3-doxy-beta-D-pent-2-eno-furanose. Of these, water and the furnose derivative were the major components. Author (TAB)

N70-27853# Institute of Nuclear Research, Warsaw (Poland).

EXPERIMENTS ON EVALUATION OF A METHOD FOR DETERMINING THE RADIOCHEMICAL PURITY OF Na(131)I

Antoni Pasternak 1969 22 p In POLISH

(INR-1060) Avail: AEC Depository Libraries

An interlaboratory study was performed for the estimation of the influence of some factors on results obtained in determination of the radiochemical purity of Na131I using the "pharmacopoeial" method. The content of iodides was controlled in two samples, one stabilized with Na2S2O3 and the other unstabilized. The method under control was ascending paper chromatography using 75% aqueous methanol solution as developer. Analysis of variance was a base for elaboration of an experimental scheme that made it possible to obtain an estimate of the influence on the results of the factors inseparably connected with the method itself, such as with activity measurements, time and specific "climate" of laboratories, the factors that have influence on the reproducibility and repeatability. The results and variances for individual stages of the experiment with estimation of their significance are collected in tables. The distinct differences between stabilized and unstabilized samples were established. Author (NSA)

N70-27862# Aerospace Corp., El Segundo, Calif. Aerodynamics and Propulsion Research Lab.
SHOCK TUBE STUDY OF RADIATION FROM S2 Technical Report, Oct. 1968 - Jun. 1969
Jerry F. Bott and Theodore A. Jacobs 30 Dec. 1969 30 p refs
(Contract F04701-69-C-0066)
(AD-701381; TR-0066(5240-20)-4; SAMSO-TR-70-33) Avail: CFSTI CSCL 7/4

Absolute emission-intensity measurements of the radiative combination of sulfur atoms S triplet P have been obtained in the temperature range from 2300 to 4800K at six wavelengths spaced between 3132 and 5461 A. The radiation intensities were proportional to the square of the sulfur atom concentration and were independent of the total pressure of the buffer gas, argon. In addition, the band structure was recorded for the wavelength interval 3600 to 4100 A with an image orthicon camera mounted in a spectrograph. The intensities between 3650 and 5461 A have similar activation energies and are interpreted in terms of the radiative transitions from the B triplet Sigma(u)(-) state of molecular sulfur, this state being populated by the mechanism of inverse predissociation. Theoretical calculations of the B triplet Sigma(u)(-) bands predicted the band shapes observed with the image orthicon and, together with the measured intensities, provide the electronic f-value for the bands. The intensities at 3132 A have a temperature dependence close to that predicted for transitions from the b Delta(u) electronic state. Author (TAB)

N70-27885# IIT Research Inst., Chicago, Ill.
ADVANCED OXIDIZER CHEMISTRY Final Report, 1 Jan. 1968 - 31 Dec. 1969
Irvine J. Solomon Feb. 1970 94 p refs
(Contract F44620-68-C-0039)
(AD-701717; IITRI-C6135-5) Avail: CFSTI CSCL 7/3

The reaction of O2F2 with perfluoropropene has been shown to yield two new OOF compounds, CF3CF2CF2OOF and (CF3)2CFOOF. Attempts were made to further characterize O2ClF3. The mechanism of the reaction of COF2 and OF2 in the presence of CsF was studied using O17 tracer techniques. A new method of perparation of CF3OOF is discussed. The reaction of CF3COF and OF2 is also discussed. A study of the reaction of O4F2 has shown it to be a better source of the OOF radical than O2F2. Papers are included on the following subjects: Additional studies concerning the existence of O3F2. The reaction of dioxygen difluoride and perfluoropropene. Preparation of 1-fluoroperoxyperfluoropropane 2-fluoroperoxyperfluoropropane. The reaction of O4F2 and sulfur dioxide. The preparation of fluoroperoxytrifluoromethane. The mechanism of the reaction of oxygen difluoride and carbonyl fluoride. The reaction of dioxygen difluoride and sulfur oxides and with sulfur oxyfluorides. The chemistry and structure of dioxygenyl fluoroborate. Fluorine-18 tracer studies and decomposition kinetics. The reaction of oxygen difluoride and sulfur trioxide. Transfer of the OF radical. The reaction of dioxygen difluoride and sulfur dioxide. Transfer of the OOF group. Indirect determination of fluorides by the EDTA titration of Samarium. Author (TAB)

N70-27901# Aerochem Research Labs., Inc., Princeton, N.J.
KINETIC AND AERODYNAMIC ASPECTS OF THE OXIDATION OF REFRACTORY MATERIALS BY DISSOCIATED GASES Final Report, 15 Nov. 1965 - 14 Nov. 1969
D. E. Rosner and H. D. Allendorf Dec. 1969 23 p refs
(Contract AF 49(638)-1637)
(AD-702134; AEROCHEM-TP-231; AFOSR-70-0181TR) Avail: CFSTI CSCL 7/4

A summary is given of the most significant results of a four year research program on the kinetics of atom/solid reactions at elevated temperatures. Microwave-discharge fast-flow vacuum system techniques, coupled with electrical resistance heating of the reacting specimens, have been used throughout. Reactions studied include the attack of isotropic and pyrolytic graphite, tungsten, molybdenum, rhenium, boron and silicon carbide by O-atoms, N-atoms, H-atoms and OH-radicals. Results have also been obtained for the reactivity of solids in important atomic mixtures (e.g., SiO_2 in O(g) + N(g) mixtures). A chronological list is provided of the 10 publications and 23 verbal presentations arising from this program. Author (TAB)

N70-27904# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SYNTHESIS AND PHYSICAL CHEMISTRY OF POLYMERS. POLYURETHANES
L. V. Stepanenko et al 19 Sep. 1969 29 p refs Transl. into ENGLISH from Sin. Fiz.-Khim. Polim., Akad. Nauk Ukr. SSR (Kiev) 1968 p 14 - 23, 185 - 192
(AD-702109; FTD-MT-24-151-69) Avail: CFSTI CSCL 11/9

Contents: Linear polyurethanes with isocyanurate cycles in chain; The change of internal energy during high elastic deformation of polyurethanes. TAB

N70-27925# Mellon Inst., Pittsburgh, Pa.
COMPUTER PROGRAMS TO AID IN THE DETERMINATION OF UNIQUE MOLECULAR FORMULAE FROM MASS SPECTRAL DATA Summary Technical Report, 1 Jul. 1967 - 31 Jan. 1969
Robert L. Anderson and James R. Boal Oct. 1969 44 p
(Contract F33615-69-C-1274)
(AD-702110; AFML-TR-68-318-SUPPL-1) Avail: CFSTI CSCL 7/4

Two computer programs developed to aid research in the application of mass spectrometric techniques to the determination of elemental composition of unknown samples are described. Annotated listings in FORTRAN are included together with instructions for the preparation of input data decks. A sample data set with the correct computer results is provided to aid the understanding of these instructions. The philosophy behind the computations performed by both programs is briefly discussed. Author (TAB)

N70-27935# Philco-Ford Corp., Newport Beach, Calif. Aeronutronic Div.
INVESTIGATION OF THE ABSORPTION OF INFRARED RADIATION BY ATMOSPHERIC GASES Semiannual Technical Report, 31 Jul. 1969 - 31 Jan. 1970
Darrell E. Burch 31 Jan. 1970 30 p refs
(Contract F19628-69-C-0263; ARPA Order 1366-1)
(AD-702117; U-4784) Avail: CFSTI CSCL 4/1

The continuum absorption by H2O between 800 and 1250/cm and by CO2 from 780 to 900/cm has been measured. The continuum results from the extreme wings of very strong absorption lines centered outside the 800-1250/cm interval. Experimental results are compared with calculated values based on various line shapes. The extreme wings of N2-broadened H2O lines produce less than 0.005 as much continuum absorption as self-broadened H2O lines at the same pressure. Self-broadened H2O lines absorb more than Lorentz-shaped lines, but the wings of self-broadened CO2 lines absorb only approximately 0.01 as much in the 780-900/cm region as if they had the Lorentz shape. The shape of the wings of the CO2 lines which produce the continuum between 780 and 900/cm are similar to those near 2400/cm for both self broadening and N2 broadening. Suggestions on method for using the results for atmospheric transmission calculations are given. Author (TAB)

N70-27953# Israel Atomic Energy Commission, Tel Aviv. Research Labs.
RESEARCH LABORATORIES Annual Report, Jan. - Dec. 1968
Jul 1969 309 p refs
(IA-1190) Avail: AEC Depository Libraries

Brief summaries are presented of the research work in various nuclear energy fields conducted during 1968 by the Israel Atomic Energy Commission. NSA

N70-28026# California Univ., Berkeley. Lawrence Radiation Lab.
THE EFFECT OF ATMOSPHERE AND GLASS COMPOSITION ON REACTIONS AT GLASS-METAL INTERFACES
John J. Brennan (Ph.D. Thesis) Jul. 1969 68 p refs
(Contract W-7405-eng-48)
(PB-187821; UCRL-19045) Avail: CFSTI CSCL 11A

Contact angles and adherence of sodium disilicate glasses with varying oxide additions on iron, cobalt, nickel, and their alloys, were studied at 1000C. When the oxide containing glasses were melted on the substrate metals in the furnace with carbon present, the glasses generally wetted the substrate, with a contact angle of approximately zero degrees, and adhered strongly. A crystalline phase of either silica or an orthosilicate usually precipitated out of the glass. When the base metal had a higher oxidation potential than the metal oxide dissolved in the glass, redox reaction took place. This resulted in the reduced metal forming a dendritic structure growing into the glass while the glass became enriched with the base metal oxide. The composition of the dendrite was determined by the relative activities of the metal oxides in the glass. Author (USGRDR)

N70-28036# Louisiana State Univ., Baton Rouge. Coll. of Engineering.
AN APPLICATION OF OPTIMAL CONTROL THEORY
John A. Miller, Cecil L. Smith, and Paul W. Murrill Dec. 1969 22 p refs
(Contract F44620-68-C-0021; Proj. Themis)
(AD-702084; THEMIS-LSU-T-TR-30; AFOSR-70-0583TR) Avail: CFSTI CSCL 7/1

The purpose of this article is to show that optimal control theory can be used to develop a control strategy for a practical system, namely a distillation column. The approach will be to model the complex system with a simple model, use optimal control theory to determine a control strategy for the simple model, and then apply the results to the original system. Author (TAB)

N70-28037# Louisiana State Univ., Baton Rouge. Coll. of Engineering.
APPROXIMATE OPTIMAL CONTROL USING SENSITIVITY COEFFICIENTS
William H. Pusch, Cecil L. Smith, and Paul W. Murrill Dec. 1969 23 p refs
(Contract F44620-68-C-0021; Proj. Themis)
(AD-702083; THEMIS-LSU-T-TR-29; AFOSR-70-0584TR) Avail: CFSTI CSCL 7/1

The applications of optimal control theory to actual chemical processes have been based on approximate, low order, linear mathematical models rather than the true process model, which is frequently unknown. The model must be sophisticated enough to fit the process well, yet simple enough so that its parameters can be evaluated without an excessive computational effort. This paper describes a model reference adaptive control strategy using sensitivity coefficients to update the model and optimal control theory to determine the control strategy, which is applied to a stirred chemical reactor. Author (TAB)

N70-28048# United Kingdom Atomic Energy Authority, Wantage (England). Research Group.
RADIATION-INITIATED FORMATION OF POLYSULPHONES IN SYSTEMS CONTAINING 1:3-BUTADIENE
P. R. Hills and R. J. Rowe Oct. 1969 15 p
(AERE-R-6223) Avail: CFSTI

High yields of polysulphones can be obtained in the sulphur dioxide butadiene system in the presence of ionizing radiation. The product is formed by an efficient chain-reaction and G-values larger than 100,000 were observed. The polysulphones produced from butadiene and a number of mixed monomer systems have all proved intractable; no adequate solvent was found for them, and their high melting points preclude fabrication at elevated temperatures. The thermal stability of the polymers was also determined. Author (NSA)

N70-28057*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
POLYIMIDES FROM SOME DIAMINOANTHRAQUINONES AND PYROMELLITIC DIANHYDRIDE
Peter Delvigs Washington May 1970 16 p refs
(NASA-TN-D-5832) Avail: CFSTI CSCL 07C

Two new polyimides were synthesized from pyromellitic dianhydride (PMDA) and two diaminoanthraquinones: 2,6-diaminoanthraquinone and its 1,5-isomer. The synthesis was accomplished through ester-blocked polyimide prepolymers by using methanol as the blocking reagent. The molecular weight of the prepolymer from 2,6-diaminoanthraquinone was increased by solid-state polymerization, after which the prepolymer was still completely soluble. Dilute solutions of the prepolymer in N,N-dimethylacetamide containing water were stable toward solvolytic degradation. Both polyimides exhibited excellent thermal stability, as measured by thermogravimetric analysis. The polyimide from 2,6-diaminoanthraquinone showed excellent weight retention, as measured by isothermogravimetric analysis in air at 316°C (600°F). Author

N70-28064# Kentucky Univ., Lexington. Dept. of Chemistry.
INTERACTION OF BORON TRIHALIDES WITH HEXAFLUOROACETONE IMINE
Kurt Niedenzu, Kenneth E. Blick, and Clifford D. Miller Dec. 1969 9 p ref
(Contract DAAB07-69-C-0366)
(AD-701701; THEMIS-UK-RR-2) Avail: CFSTI CSCL 7/3

Boron trifluoride forms a 1:1 addition compound with (CF3)2CNH. In contrast, BCl3 and BBr3 add across the CN double bond of the imine to yield (CF3)2CX-NH-BX2 derivatives. The structure of these aminoboranes was verified by vibrational spectroscopy. Author (TAB)

N70-28073# Oak Ridge National Lab., Tenn.
EFFECT OF ZINC AND ALUMINUM ON THE CORROSION OF BRASS IN POLLUTED WATER
Zenichi Tanabe 1969 11 p refs Transl. into ENGLISH from Nippon Kinzoku Gakkaishi (Japan), v. 27, no. 7, 1963 p 337 - 341
(PB-187709; ORNL-TR-2232) Avail: CFSTI CSCL 11F

A study was made to see if the addition of cystine to clean sea water would have any effect on the electrochemical properties of aluminum brass. Also studied were the possible effects due to changes in the amounts of Al and Zn which are constituents of this alloy, on the corrosion rate using electrochemical measurements. The results obtained were as follows: (1) Mainly, cystine accelerates cathodic reation rate, its effect is remarkable especially in absence of oxygen; (2) Although effects of zinc and aluminum contents on electrochemical properties relate linearly to zinc equivalent, there is a discontinuous point at about 32% Zn

eq., below which cathodic critical current decreases with zinc equivalent; (3) There is some relation between the discontinuous points and precipitation of beta phase. Author (USGRDR)

N70-28074# Oak Ridge National Lab., Tenn.
INFRARED ABSORPTION SPECTRA OF THE SULFATE OF NICKEL, COBALT, ZINC AND MAGNESIUM
Claude Rocchiccioli 1969 7 p refs Transl. into ENGLISH from Acad. Des. Sci. (France), v. 257 1963 p 3851 3854
(PB-187810T; ORNL-TR-1547) Avail: CFSTI CSCL 07B

Comparison of spectra of the heptahydrates and heptadeuterates of the sulfates of nickel, cobalt, zinc and magnesium and the corresponding anhydrous salts show that the vibrations of the SO4 framework are affected by the proximity of water molecules (V4 for the heptahydrates is located at about 1085/cm, in place of 1150/cm for the anhydrous salts). The distortion vibration of the water at about 1610-1630/cm is compatible with the presence of loosely bound water of crystallization. A band of hindered rotation of water at about 770/cm confirms the existence of an appreciable number of hydrogen bonds inside the (M(H2O)6) SO4H2O structure. Author (USGRDR)

N70-28075# Oak Ridge National Lab., Tenn.
DETERMINATION OF HEATS OF FORMATION OF COPPER OXIDES
Daniel Balesdent 1969 4 p refs Transl. into ENGLISH from Acad. Des. Sci. (France), v. 240, 1955 p 1884 1887
(PB-187753T; ORNL-TR-2238) Avail: CFSTI CSCL 07D

The activities of copper in gold-copper alloys have been determined, and these values, combined with those of dissociation pressures of the oxides of copper in the presence of gold measured by Chiche others, furnish numbers which are very close to those adopted by the National Bureau of Standards for standard heats of formation of copper oxides. Author (USGRDR)

N70-28122# Massachusetts Inst. of Tech., Cambridge. Lab. for Insulation Research.
THE DIELECTRIC RELAXATION SPECTRA OF WATER, ICE, AND AQUEOUS SOLUTIONS AND THEIR INTERPRETATION
Arthur R. Von Hippel, Dieter B. Knoll, Modesto A Maidique, and W. B. Westphal Feb. 1970 56 p refs
(Contract N00014-67-A-0204-0003)
(AD-702073; TR-8) Avail: CFSTI CSCL 7/4

The report consists of three scientific papers, the outcome of three years of experimental work on ice I(h) single crystals and its theoretical interpretation. In the first paper a short description is given of crystal growing and sample handling techniques and of equipment covering the range (10 to the 5th) to (8 x 10 to the -3rd) Hz, OC to -180C. Rigorous control of error limits and an improved computerized evaluation procedure alloys to resolve the dielectric spectrum of ice into four significant components with very characteristic trends. The interpretation of these data requires new models developed in the second paper. The third paper supplements the a-c polarization studies by d-c and transient measurements ranging from 0.01 to 40000 V/cm, from nanoamperes to microamp, and from 100 microseconds to 3 hrs. It appears that an ideal ice crystal seems really to have no ionic charge carrier transport through its volume but a very strong one along its surfaces. Instead of a saturation current we find a small extrinsic saturation charge, extractable in high fields and giving no evidence of a special proton transfer mechanism across hydrogen bridges. Aged single-crystal samples show six clearly separated relaxation spectra. Many contradictory statements in the literature about activation energies of conduction, etc., become clarified experimentally and understood. Author (TAB)

N70-28141# California Univ., Berkeley. Lawrence Radiation Lab.
THE PRODUCTION, REACTIONS AND SPECTRA OF LOW-VALENT, HIGHLY REACTIVE CHEMICAL SPECIES WITH SPECIAL EMPHASIS ON THE PHOSPHORUS FLUORINE SYSTEM
David Solan (Ph.D. Thesis) Aug. 1969 247 p refs
(Contract W-7405-eng-48)
(PB-187819; UCRL-19049) Avail: CFSTI CSCL 07B

In this method, high energy species are cocondensed with molecules of a reactant on a 77K surface. Reactions proceed in the 'liquid-like, intermediate, transitory' ('LLIT') state of matter formed while condensation is proceeding. Radicals investigated in this work include GeH2, SiF2, GeF2, PF2, PF and CS. New compounds formed include GeH3SiF2H, GeH3SiF3, GeH3Si2F4H, GeH3Si3F6H, P3F5, and P4F6. The fluorogermylsilanes were made by cocodensation of SiF2 and GeH4. P3F5 and P4F6 were made by the cracking of P2F4 at 900C followed by the immediate condensation of the products of this cracking at 77K. P4F6 has been characterized through mass spectra, fluorine and phosphorus nmr spectra, infrared absorption spectra elemental analysis. P2F4 was shown to undergo heterolytic and homolygic fission, when pyrolyzed at 700C, to form PF and PF2 radicals. Photolysis of P2F4 in the matrix environment produces PF3 and P3F5 in an unusual excitation photolysis, wherein the reaction takes place, in the matrix environment, between excited chemical species. Some or all of the fundamental modes of vibration in the matrix environment have been determined for each of the following species using infrared absorption spectroscopy: PF, PF2, PF3, P2F4, P3F5 and P4F6. Author (USGRDR)

N70-28143# California Univ., Berkeley. Lawrence Radiation Lab.
INTERFACIAL MIXING CELLS AND MASS TRANSFER IN TURBULENT FLOW
William H. Brown (Ph.D. Thesis) and C. Judson King (Ph.D. Thesis) Aug. 1969 109 p refs
(Contract W-7405-eng-48)
(PB-187955; UCRL-18974) Avail: CFSTI CSCL 07A

The effect of a rippling interface upon surface tension-driven cellular convection was experimentally investigated by contacting ethyl ether in tridecane solvent with nitrogen, both phases flowing in a cocurrent, stratified manner. In order to determine the influence of interfacial rippling upon Marangoni cells the liquid volumetric flow rate was increased until the interface was visibly disturbed by wavelets. The individual liquid-phase mass-transfer coefficient was obtained from the experimental mass-transfer data by assuming that the gas-phase resistance to mass transfer was equal to that resistance measured in the absence of or suppression of resistance in the liquid phase. Author (USGRDR)

N70-28144# California Univ., Livermore. Lawrence Radiation Lab.
POSSIBILITY OF OBTAINING A NEGATIVE ABSORPTION COEFFICIENT IN CHELATE COMPOUNDS OF RARE-EARTH ELEMENTS [O VOZMOZHNOSTI POLUCHENIYA OTRITSATELNOGO KOEFFITSIENTA POGLOSHCENIYA V ZHELATNYKH OEDINENIYAKH REDKOZEMELNYKH ELEMENTOV]
D. P. Gribkovskii et al Sep. 1969 383 p refs Transl. into ENGLISH from Zh. Prikl. Spektroskopii, Akad. Nauk Belorussk. SSR (Minsk), v. 1, no. 4, 1964 p 340-347
(PB-187815T; UCRL-Trans-10383) Avail: CFSTI CSCL 07D

The possibility of using chelate compounds of europium and terbium to obtain stimulated emission is investigated. Experimental values of investigated qualities, threshold transition probabilities calculated from the formula for a seven-level scheme, and ratios of the thresholds to the generation threshold in europium benzoylacetonate are given. Author (USGRDR)

N70-28155# Avco-Everett Research Lab., Everett, Mass.
TRANSFER OF VIBRATIONAL ENERGY FROM ASYMMETRIC STRETCH OF CO2 TO NU SUB 3 OF N2O
R. D. Sharma Nov. 1969 53 p refs
(Contract F29601-69-C-0060)
(AD-702132; AERL-RR-339) Avail: CFSTI CSCL 7/4

The rate constant for the transfer of a v3 quantum from CO2 to N2O is calculated using a second order formulation of the theory of energy transfer due to long range forces. This formulation is valid if (omega(vi))(tau) > 1, where omega(vi) is the frequency (radians/sec) for transition from initial to virtual state and tau is the time duration of the collision. The theory is estimated to be accurate to within a factor of 2 and agrees with the room temperature experimental results. The formulation is also generalized to include energy transfer due to Debye induction interactions.
Author (TAB)

N70-28170 Georgia Inst. of Tech., Atlanta.
THE ELECTRONIC STRUCTURE OF SQUARE-PLANAR NICKEL (II) AND COPPER (II) COMPLEXES
Vernon H. Schievelbein (Ph.D. Thesis) 1969 104 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 69-19794

The electronic structure of square-palanar copper(II) and nickel(II) complexes was studied using spectral and magnetic methods. The study concentrated attention on complexes using a simple saturated amine, 1, 5-diazocyclooctane, as the ligand and the results were related to more complicated systems. Ligand field calculations indicate that the three excited states are of very nearly the same energy. The one absorption band observed in the visible spectra of these complexes is assumed to correspond to electronic transitions from the ground state to the three excited states. Because of the order of the levels and the relatively small shift of the absorption brand in various solvents, the electron-electron interaction is assumed to be very important in the nickel(II) complexes.
Dissert. Abstr.

N70-28171 Pennsylvania Univ., Philadelphia.
PROPERTIES AND REACTIONS OF METALLIC PALLADIUM AND PALLADIUM(II) COMPLEXES
Robert Frederick Schramm (Ph.D. Thesis) 1969 159 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 69-21424

Catonic palladium(II) and neutral complexes were prepared and partially characterized. The cationic complexes were prepared by two general synthetic methods: (1) titration of a solution of palladium chloride in a donor solvent with anhydrous silver perchlorate solution, and (2) reaction of metallic palladium with nitrosyl tetrafluoroborate in acetonitrile. This acetonitrile complex is a useful precursor to other cationic Pd(II) complexes. The neutral complex, prepared by the reaction of metallic palladium with dintrogen tetroxide in acetonitrile, is also assumed to be a useful precursor to other palladium nitrate complexes. All of the palladium(II) complexes prepared were found to be four coordinate and diamagnetic and thus consistent with square planar geometry. The electronic spectra of these complexes were recorded both in solution and in nujol mulls. Extended Huckel molecular orbital calculations were carried out to understand how the relative d orbital energy level ordering depended on the choice of ligand. Electronic absorption bands were assigned in view of the results of the molecular orbital calculations.
Dissert. Abstr.

N70-28178# Joint Publications Research Service, Washington, D.C.
CATALYTIC SYNTHESIS OF CARBOHYDRATES FROM FORMALDEHYDE
O. V. Krylov et al *In its* Space Biol. and Med., Vol. 4, No. 1, 28 Apr. 1970 p 6 - 14 refs (See N70-28176 14-04)
Avail: CFSTI

The effect of different variables (temperature, type of solvent, catalyst, and formaldehyde concentrations) on the rate of formaldehyde condensation, yield, and chemical composition of synthetic carbohydrates (monosaccharides) was investigated. No direct relationship was found between the reaction rate and catalyst and formaldehyde concentration. The use of alcohol gave an increased yield of monosaccharides. Chromatographic analysis revealed that the resulting monosaccharides are primarily aldosaccharides (pentoses and Hexoses). The kinetics of the reaction can be described by the autocatalysis equation. The activation energy in the presence of calcium hydroxide is 11.3 Cal/mole.
Author

N70-28190# Joint Publications Research Service, Washington, D.C.
USE OF THE COMPLEX-FORMING PROPERTIES OF METALS FOR FREEING ATMOSPHERIC CONDENSATE FROM AMMONIUM IONS
L. E. Yegorova et al *In its* Space Biol. and Med., Vol. 4, No. 1, 28 Apr. 1970 p 81 - 86 refs (See N70-28176 14-04)
Avail: CFSTI

A study was made of the sorption of ammonium, which is one of the main components of atmospheric condensate, from water solutions by means of cation exchange resins in the Me form. The relationship between the volume capacity of cationites in Me form, the ammonium concentration in the solution and the hydrogen ion concentration was examined. It was found that the use of cationites in Me form (particularly in the Cu form) increased their ammonium capacity.
Author

N70-28214# California Univ., Berkeley. Lawrence Radiation Lab.
STUDIES ON THE ANODIC DISSOLUTION OF COPPER AT HIGH CURRENT DENSITIES
Kimio Kinoshita (Ph.D. Thesis) Sep. 1969 176 p refs
(Contract W-7405-eng-48)
(PB-187818; UCRL-19051) Avail: CFSTI CSCL 07D

A fundamental investigation was conducted on the influence of electrochemical and mass transfer phenomena on the anodic dissolution of copper under conditions comparable to electrochemical machining. Maximum current densities of 80 amp/sq cm and flow rates of 600 - 700 cm/sec were used in a 3 mm wide rectangular flow channel with a 1 mm electrode separation. The apparent valence of copper dissolution was determined from anode weightloss measurements at various flow rates in 2N KNO3, 1N K2SO4, 1N H2SO4, and 2N KCl. An experimental determination, using a commercial oxygen analyzer, showed that less than 1% of the total current was consumed in the anodic evolution of oxygen. A motion picture study of anodic copper dissolution under free convection verified that the formation of passivating layers is associated with a step increase in cell voltage.
Author

N70-28230# California Univ., Los Angeles. Dept. of Chemistry.
NOVEL CHELATED BISCARBORANE TRANSITION METAL COMPLEXES FORMED THROUGH CARBON-METAL SIGMA BONDS
David O. Owen and Frederick M. Hawthorne 28 Jan. 1970 12 p refs Submitted for publication
(Contract N00014-67-A-0111-0021)
(AD-702088; TR-12) Avail: CFSTI CSCL 7/2

A series of square planar and tetrahedral complexes have been prepared which contain the bidentate bis-carborane ligand sigma-bonded through carbon to a transition metal. These complexes of B10C2H10(-), dodecahydrodicarba-closo-borate (-1), exhibit unusual thermal and chemical stabilities.
Author (TAB)

N70-28293# Naval Research Labs., Washington, D.C.
CHEMISTRY: PROBLEM NOTES
In its Rept. of NRL Progr. Mar. 1970 p 24-26 (See N70-28291 14-34)
Avail: CFSTI

Research in electrochemical power sources and radiochemical studies of physical chemical mechanisms are reported. Topics covered include: (1) cycling anodic coatings on pure and antimonial lead in sulfuric acid, (2) morphological changes in the lead dioxide electrode during its reduction and reoxidation; and (3) filtration of particles of atomic dimensions. D.L.G.

N70-28308 Kansas State Univ., Manhatten.
NONLINEAR PARAMETER ESTIMATION AND SENSITIVITY ANALYSIS FOR CHEMICAL PROCESS SYSTEMS
Leigh Elroy Stamets (Ph.D. Thesis) 1969 223 p
Avail: Univ. Microfilms: HC $10.15/Microfilm $3.00 Order No. 69-21143

Parameter estimation assists in establishing the probable lack of precision of the parameter values. The results of sensitivity analysis predict the effect this uncertainty will have on the system. In a reverse role, sensitivity analysis indicates the degree of precision of the parameter estimates required from experimental data in order that the inaccuracy of the estimates will not cause the actual process conditions to differ unacceptably from the desired design conditions. Criterion functions, confidence regions, and experimental designs for parameter estimation are discussed. Various methods for determining the parameter estimates are considered both for algebraic and differential nonlinear models. Linearization, steepest descent, or direct search methods are examined for minimizing the criterion functions. The equivalence of the Gauss or linearization method and the quasilinearization method allows techniques from both approaches to be combined. Dissert. Abstr.

N70-28328 Kansas State Univ., Manhattan.
PRESSURE AND RADIANT ENERGY EFFECTS IN THE BOMBARDMENT OF SOLID PROPENE WITH HYDROGEN ATOMS
Donald Winston Rathburn (Ph.D. Thesis) 1969 105 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 69-21139

The objectives of this study were to explore the role of radiant energy emanating from a hot filament and the effect of hydrogen pressure during the hydrogen atom bombardment of propene at 77 K. The first objective was accomplished by varying the radiant energy upon the frozen propene film deposited on the reaction vessel walls. The second objective was studied by determining product yield and product distribution over two pressure ranges. The product yield was found to be dependent upon the volume of the system. A model has been proposed wherein the propene film behaves analogous to a getter in a vacuum tube. The hydrogen atoms are scavenged from the system by the propene. The low pressure of these studies, 0.0002 torr, is apparently low enough to eliminate hydrogen atom recombination. Dissert. Abstr.

N70-28339# Frankford Arsenal, Philadelphia, Pa.
INFRARED DETERMINATION OF INORGANIC SULFATES AND CARBONATES BY THE PELLET TECHNIQUE
David E. Chasan and George Norwitz Nov. 1969 48 p refs
(AD-700126; FA-T69-10-1) Avail: CFSTI CSCL 7/4

The infrared spectra of sulfates and carbonates in the solid state are discussed. Methods are proposed for the determination of single sulfates (barium, strontium, sodium, and potassium sulfates) by the pellet technique. The peaks recommended for barium and strontium sulfates are 983/cm and 993/cm, respectively. Sodium and potassium sulfates are both measured at 619/cm. A procedure is proposed for the determination of barium and strontium sulfates in the presence of each other by measurements at 983/cm and 993/cm, respectively. Methods are proposed for the determination of single carbonates (barium, strontium, and calcium carbonates) by the pellet technique. Measurements for the barium, strontium, and calcium carbonates are made at 693/cm, 704/cm, and 712/cm, respectively. The procedure cannot be used for the determination of sodium or potassium carbonates because of the hygroscopicity of these compounds. A procedure is described for the determination of barium, strontium, and calcium carbonates in the presence of each other by measuring the peak heights at 693/cm, 704/cm (or 698/cm), and 712/cm, respectively. The methods for the determination of barium and strontium sulfates in the presence of each other, and barium, strontium, and calcium carbonates in the presence of each other can be used down a concentration of 5% for the minor constituent. For lower percentages the errors are rather large. Author (TAB)

N70-28346# California Inst. of Tech., Pasadena.
AFOSR PROGRAM ON LIQUID STRUCTURE Final Technical Report, 1 Sep. 1967 - 31 Aug. 1969
C. J. Pings 29 Dec. 1969 31 p refs
(Grant AF-AFOSR-1382-68)
(AD-700350; AFOSR-70-0215TR) Avail: CFSTI CSCL 7/4

The report describes the progress and reports occurring during a two-year interval for a program of experimental and theoretical study of forces and configurations at the molecular level in simple fluids. The mapping of the structure of liquid argon was extended, with the completion of experiments and data analysis at six new thermodynamic states in the dense liquid domain. A special apparatus has been constructed to permit the experimental study of intermolecular forces. A torsional crystal viscometer designed for studies of viscosity anomalies in the critical region of xenon is now operating. Author (TAB)

N70-28391# National Bureau of Standards, Washington, D.C.
THE SAMPLE, THE PROCEDURE, AND THE LABORATORY
W. J. Youden *In its* Precision Meas. and Calibration, Vol. 1 Feb. 1969 p 139-145 refs Repr. from Anal. Chem., v. 32, no. 13, Dec. 1960 8 p (See N70-28376 14-19)
Avail: SOD $5.50

A statistical method of analyzing interlaboratory chemical test data is discussed. Possible differences in precision between laboratories are considered, and it is felt that if differences exist they are minor. Systematic errors are described, and a method is given for separating systematic and random errors. N.E.N.

N70-28459# Cordoba National Univ. (Argentina). Inst. of Chemical Sciences.
DEHYDROAROMATIC STUDIES Final Report, 1 Dec. 1967 - 30 Nov. 1969
Hector E. Bertorello Jan. 1970 28 p refs
(Grant AF-AFOSR-1425-68)
(AD-700399; ARL-70-0004T) Avail: CFSTI CSCL 7/3

The reaction mechanism of carboxybenzene-diazonium compounds and its formation of benzyne is discussed. Also discussed is the formation of polymers from the heating of benzyne. TAB

N70-28463# Bureau of Mines, Washington, D.C.
ELECTROWINNING MISCH METAL FROM A TREATED BASTNASITE CONCENTRATE
E. S. Shedd, J. D. Marchant, and M. M. Wong Jun. 1970 15 p refs
(BMRI-7398) Avail: CFSTI

Misch metal was electrowon from a treated bastnasite concentrate in a REF3-LiF-BaF2 electrolyte at 950 C. The metal was prepared and tapped from a 1,000-ampere cell, and nearly 100-percent utilization of the rare-earth oxide was achieved. Prolonged operation in a smaller cell (40 amperes) indicated that the composition of the misch metal product was reasonably constant, and no significant increase of impurities, with the exception of carbon, was noted. Author

N70-28479# Wisconsin Univ., Madison. Dept. of Statistics.
SOME PROBLEMS IN THE ANALYSIS OF MULTIRESPONSE MODELS
G. E. P. Box, W. G. Hunter, J. Erjavec, and J. F. Mc Gregor Jul. 1969 36 p refs
(Contract Nonr-1202(17); NSF GP-2755)
(AD-702076; UWIS-DS-69-212) Avail: CFSTI CSCL 7/4

Engineers and chemists frequently need to analyze multiresponse data. For example, when studying a chemical reactch reactor, for each setting of a group of input variables determining the reaction conditions (such as temperature, pressure, reaction time and the initial concentrations of the reactants) a number of output variables or responses (such as the final concentrations of each of the chemical substituents) may be measured. The capability of making such multiple measurements has greatly increased since the advent of better analytical tools such as the gas chromatagraph. But problems frequently arise in the analysis of such multiresponse data. One major source of problems arises from dependencies among the responses. Different kinds of dependencies can exist giving rise to different kinds of problems. The object of this paper is to consider certain aspects of the analysis of data of this kind and to present an illustrative example. Author (TAB)

N70-28489# Rocket Propulsion Establishment, Westcott (England).
MECHANISM OF THE DECOMPOSITION OF AMMONIUM PERCHLORATE
G. S. Pearson and P. W. M. Jacobs (Western Ontario Univ.) May 1969 28 p refs
(AD-702569; RPE-TR-69/6) Avail: CFSTI CSCL 7/4

Although it is generally accepted that the principle initial step in the decomposition of ammonium perchlorate is proton transfer, details of the subsequent reactions have not been resolved. In this report, full use is made of recently published data on perchloric acid and chlorine dioxide flames, on the oxidation of ammonia, on the reactions of nitroxyl and on the reactions of the chlorine oxides, to deduce a detailed mechanism for the chemical decomposition of ammonium perchlorate. Whilst emphasis has been given to the high temperature decomposition, the basic mechanism is adaptable to a wide range of conditions: to the low temperature decomposition, to combustion, to the catalysed decomposition and to decomposition under various reactive gases. The central feature of the mechanism is that, in the decomposition of ammonium perchlorate, ammonia is oxidized principally by the ClO radical. Author (TAB)

N70-28497# Dow Chemical Co., Golden, Colo. Rocky Flats Div.
SPECTROPHOTOMETRIC DETERMINATION OF PLUTONIUM III, IV, AND VI IN NITRIC ACID SOLUTIONS
Paul G. Hagan and Frend J. Miner 24 Nov. 1969 10 p refs
(Contract AT(29-1)-1106)
(REP-1391) Avail: CFSTI

A method is reported for the quantitative spectrophotometric determination of plutonium (III), (IV), and (VI) existing separately or in mixed oxidation states in nitric acid. The nitric acid concentration varied from 1 to 4 molar for Pu(III), and 1 to 10 molar for Pu(IV) and (VI). Molar absorptivity values are given for the major absorption peaks with an evaluation of their spectral reproducibility. With these absorptivity data and the mathematical approach to Ochsenfeld and Schmieder a method is presented for a calculation to determine the molar concentration of each oxidation state. Author

N70-28537# Cornell Univ., Ithaca, N.Y. Dept. of Chemistry.
MECHANISMS OF ACID-BASE CATALYSIS AND STUDIES IN DEUTERIUM OXIDE AS SOLVENT Technical Progress Report, 1 Jan. - 31 Dec. 1969
F. A. Long 31 Dec. 1969 7 p refs
(Contract AT(30-1)-1725)
(NYO-1725-36) Avail: CFSTI

Progress is reported on research in detritiation of 1,4-dicyano-2-butene-1-t in aqueous solution, ionization of malononitrile and tert-butylmalononitrile, the use of a kinetic probe for basicity and its relevance to water structure, and study of reactions of the beta-diketone, 3-methylpentanedione-2,4 in the mixed H2O - D2O solvent system. NSA

N70-28545# Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Inst. fuer Strahlenschutz.
SOME RESULTS ON THE REMOVAL OF RADIOCESIUM FROM LOW-ACTIVITY WASTE WATER BY COPRECIPITATION WITH FERROCYANIDES
Ch. Friedmann and T. Schoenfeld (Wien Univ.) 1969 11 p refs
Submitted for publication
(SGAE-SS-6/1969) Avail: CFSTI

Coprecipitation of Cs-137 with small amounts of cupric and ferric ferrocyanides from actual waste water was investigated. The results indicate that if moderate decontamination factors (30 to 50) suffice, reagent quantities smaller than those now in use at various plants for the treatment of low activity waste can be employed. Author

N70-28573# Atomic Energy Board, Pretoria (South Africa).
DECONTAMINATION OF RADIOACTIVELY CONTAMINATED MATERIALS
H. J. van der Westhuizen, J. W. van Averbeke, and G. L. F. E. Bruyninckx Jun. 1969 12 p refs
(PEL-187) Avail: AEC Depository Libraries

The most frequently occurring contamination mechanisms and factors influencing decontamination are summarized. Solutions and procedures for the decontamination of various types of surfaces, used at the AEB, and the success obtained, are reported. Author (NSA)

N70-28580# Dartmouth Coll., Hanover, N.H.
COBALT SORPTION ON SURFACE REACTIVE MINERALS IN THE GLACIAL ENVIRONMENT Progress Report, Feb. - Dec. 1969
R. C. Reynolds, Jr. Dec. 1969 10 p refs
(Contract AT(30-1)-3912)
(NYO-3912-2) Avail: CFSTI

Studies continued on the distribution and genesis of natural ion-exchangers produced by chemical weathering in the temperate, maritime, glacial environment. In addition, a quantitative analysis was made of the chemical weathering rates in the South Cascade Glacier area. Finally, laboratory investigations made considerable progress toward explaining the mechanisms involved in the specific sorption of tracer levels of cobalt by vermiculite. Collectively, these studies will form the basis for a quantitative model of the geochemistry of tracer levels of cobalt in such environments. Author

N70-28594# Iowa State Univ. of Science and Technology, Ames. Dept. of Chemistry.
SUBSTITUTION REACTIONS OF DICHLORO (ETHYLENEDIAMINE)PLATINUM(II)
Ronald Frank Coley (Ph.D. Thesis) Nov. 1969 99 p refs
(Contract W-7405-eng-82)
(IS-T-329) Avail: CFSTI

The kinetics and equilibria for the successive aquation reactions of dichloro(ethylenediamine)platinum(II) were studied by spectrophotometric methods and by titrations of the acidic protons on the H2O ligands formed according to the given reactions. Titrations of equilibrium solutions were performed over the range of 0.0001 to 0.001 M total complex concentration at an ionic strength of 0.318 for 25, 30, and 35 C. Values for the reverse reactions were determined spectrophotometrically from the relaxation periods when high chloride concentrations were added to equilibrium solutions. Values for forward reactions were determined spectrophotometrically and from pH-stat studies in basic solutions. NSA

N70-28610 European Organization for Nuclear Research, Geneva (Switzerland). Nuclear Physics Div.
THE HYDROXIDES OF TITANIUM, ZIRCONIUM, CERIUM(4), AND THORIUM FOR ON-LINE PRODUCTION OF NOBLE GASES
P. Patzelt *In its* The ISOLDE Isotope Separator On-Line Facility at CERN 19 Jan. 1970 p 81–91 refs (See N70-28603 14-22)
Copyright. Avail: Issuing Activity

Off-line experiments are described to test the applicability of the hydroxides of titanium, zirconium, cerium, and thorium for on-line production of noble gases. The cumulative yield distributions of krypton, xenon, and radon isotopes from the spallation of zirconium, cerium, and thorium by 600 MeV protons were measured to show quantitatively the intensities to be expected on-line. Cumulative yields are given in terms of saturation activities normalized to certain experimental conditions corresponding to those encountered in the on-line experiment. Author

N70-28612 Oslo Univ. (Norway). Dept. of Chemistry.
TELLURIUM TETRACHLORIDE AS A TARGET FOR PRODUCTION OF TIN AND ANTIMONY
J. Alstad, B. Bergersen, T. Jahnsen, A. C. Pappas, and T. Tunaal *In* CERN The ISOLDE Isotope Separator On-Line Facility at CERN 19 Jan. 1970 p 109–122 refs (See N70-28603 14-22)
Copyright. Avail: Issuing Activity

Neutron-deficient isotopes of tin and antimony are considered for developing a target material and separation methods suitable for study of these isotopes. Tellurium tetrachloride was chosen as the target element because of the combined conditions of high spallation of neutron-deficient isotopes of tin and antimony and the requirement for as little interference as possible from the volatile elements iodine and xenon. R.B.

N70-28624# Joint Publications Research Service, Washington, D.C.
STUDY OF THE RADIOPROTECTIVE EFFECT OF A POLYMER SALT OF CYSTAMINE AND A PROPANESULFONATE ESTER OF DEXTRAN
M. N. Trushina et al 14 May 1970 7 p refs Transl. into ENGLISH from Vop. Med. Khim. (USSR), no. 2, 1970 p 195–198
(JPRS-50524) Avail: CFSTI

Addition of cystamine to the propane sulfonate ester of dextran considerably improves the radioprotective effectiveness of small doses of cystamine when the compound is administered 10 to 15 minutes before irradiation. Cystamine added to the polymer has a longer period of action than cystamine dihydrochloride, and can be administered one hour before irradiation. Author

N70-28661# Bureau of Mines, Salt Lake City, Utah. Metallurgy Research Center.
ELECTROCHEMICAL RECOVERY OF HIGH-PURITY NICKEL AND COBALT FROM CRUDE NICKEL AND FERRONICKEL
P. T. Brooks and G. M. Potter Jun. 1970 30 p
(BMRI-7402) Avail: CFSTI

Semipilot scale tests were made to demonstrate a newly developed electrorefining process which could be extrapolated to commerical scale in producing high-purity nickel and cobalt from crude nickel metal and high-grade ferronickel. The new process comprises application of solvent extraction techniques to remove and separate cobalt and iron from nickel and the electrodeposition in diaphragm cells of pure nickel and cobalt from chloride-based purified electrolyte. Using water insoluble organic amines, the solvent extraction operations enabled production of commercial-sized nickel and cobalt cathodes of higher purity than that of commercial electrolytic metals. The solvent extraction operation for separation of cobalt from nickel was made simpler than the conventional method. The solvent extraction operation for iron removal made possible the electrorefining of ferronickel without the prohibitive loss of nickel resulting from the method ordinarily used for iron removal. Author

N70-28673*# Stanford Research Inst., Menlo Park, Calif.
FLAMMABILITY OF OF2 AND B2H6 UNDER THE CONDITIONS OF SATURATED VAPOR PRESSURES OF THE TWO COMPONENTS AND INERT PRESSURIZING GAS BETWEEN 200 AND 300 R
W. E. Tolberg and R. S. Stringham 19 Feb. 1970 19 p refs
Prepared for JPL *Its* Spec. Rept. No. 951581-10
(Contracts NAS7-100; JPL-951581; SRI Proj. 6063)
(NASA-CR-110138) Avail: CFSTI CSCL 07D

The flammability limits of mixtures of B2H6 and OF2 at their respective saturated vapor pressures between 200 and 300 R have been determined in the presence of the inert gases He and N2 at total pressures of 100 and 500 psia. With one exception, B2H6 and OF2 did not react explosively in the prescribed mixture ratios when held at the experimental temperatures. The one exception where an explosion occurred involved a mixture ratio such that the concentrations of OF2 and of B2H6 were very nearly equal to the ratio of their respective vapor pressures at the experimental temperatures. Thus far there seems to be no rational explanation for the explosive behavior of this mixture in view of the fact that no such explosions occurred in similar and closely related mixtures. Numerous explosions were observed when efforts to separate the reaction products were carried out by reducing the temperature to the extent that a liquid phase of OF2 and a solid phase of B2H6 were present. During determinations of whether the mixtures of B2H6 and OF2 had reacted without explosion, B2H6 could be isolated from the mixture, and the absence of the expected reaction product BF3 indicated that barring explosion no reaction had occurred. Author

N70-28676*# Idaho State Univ., Pocatello. Dept. of Chemistry.
INVESTIGATION OF ELECTRODE MATERIALS FOR ALKALINE BATTERIES Quarterly Report
G. Myron Arcand 25 Feb. 1970 19 p refs Prepared for JPL *Its* Re-Order No. 70-154
(Contracts NAS7-100; JPL-952265)
(NASA-CR-110134; QR-7) Avail: CFSTI CSCL 07D

Both AgO and Ag2O are activated by heat to adsorb oxygen or some other gas from the atmosphere. The minimum activation temperature appears to be about 60 deg for AgO with more effective activation occurring at higher temperatures. No minimum has been determined for Ag2O; however, significant adsorption does occur on the material. If long periods at 66 deg are repeated, activation appears to be increased. At the same time, the weight loss during heating is greater. This suggests an activation for both adsorption and desorption. On the other hand, repeated shot

periods at 66 deg seem to have an opposite effect as though the material were being annealed. The thermal decomposition of AgO and Ag2O and the amalgam electrode were studied. Gold chloride and stannous oxide dissolved in concentrated KOH are unsatisfactory cathode materials. The copper-amalgam/cupric ammine system may prove useful as a cathode although the conductivity of the electrolyte solution is low. The zinc-amalgam/zincate system shows promise of fairly high discharge rates, but the open-circuit potential of this cathode combined with the potassium-amalgam anode is only 0.57 V. Author

N70-28698*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OXIDATIVE CAPACITY OF MAGMATIC COMPONENTS
Robert F. Mueller May 1970 15 p refs Submitted for publication
(NASA-TM-X-63928; X-644-70-196) Avail: CFSTI CSCL 07D

The capacity of magmatic components such as dissolved or precipitated ferrous and ferric iron compounds and water to control the oxygen fugacity of magmas is treated from a theoretical standpoint. Stoichiometric calculations indicate that in relatively anhydrous magmas, such as those of the Skaergaard complex, the oxygen fugacity is determined by the reaction of ferrous and ferric iron if these are abundant relative to the quantity of dissolved water. However if the quantity of water is high relative to iron, as in the calc-alkali batholiths, the oxygen fugacity is likely to be determined by the dissolved water of a given H2O/H2 ratio and by the tendency of H2O to react with the Si-O-Si bridges of the silicate melt. Author

N70-28701*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
STABILITY RELATIONS OF SIDERITE (Fe CO3), DETERMINED IN CONTROLLED-f sub O2 ATMOSPHERES
Bevan M. French Mar. 1970 66 p refs Submitted for publication
(NASA-TM-X-63895; X-644-70-102) Avail: CFSTI CSCL 07D

Stability relations of siderite in the system Fe-C-O were determined between 500 and 2000 bars in a CO2 + CO atmosphere as a function of T, P sub F, and f sub O2, using solid phase oxygen buffers. Siderite was synthesized for the experiments by decomposition of ferrous oxalate dihydrate in sealed tubes at 2000 bars and approximately 380 C. During stability runs, f sub O2 was controlled by surrounding the siderite sample with either graphite or hematite-magnetite buffer mixtures. The stability field of siderite + gas in P sub F - T - f sub O2 is a narrow wedge bounded by stable divariant reaction surfaces representing decomposition of siderite to: (1) hematite + gas; (2) magnetite + gas; (3) magnetite + graphite + oxygen. The later reaction surface lies entirely in the condensed region below the graphite buffer and is not experimentally accessible. Reactions of siderite to form iron or wustite are not stable. The stability relations of natural iron-rich carbonates are more complex than those determined for pure siderite. Author

N70-28769# North Carolina Univ., Chapel Hill.
IMPURITY TRACER DIFFUSION IN SILVER HALIDES
A. P. Batra, A. L. Laskar, G. Brebec, and L. Slifkin [1969] 12 p refs Presented at the Symp. on Diffusion Processes, Glasgow, 22-24 Sep. 1969
(Contract AT(40-1)-2036)
(ORO-2036-13; CONF-690936-1) Avail: CFSTI

Recent experiments on impurity tracer diffusion in AgCl and AgBr are summarized. Chlorine gas is shown to suppress the interstitial diffusion of Au(+) in AgCl at low temperatures. The data may be analyzed to yield 0.6eV as the heat of solution of excess chlorine to form a silver vacancy and an electron hole. Evidence is presented that while cations without d-shell electrons diffuse entirely by a substitutional mechanism, for those with outer d-electrons the interstitial mechanism is dominant over at least part of the temperature range. Measurement of the diffusion of halide impurity in AgCl and AgBr shows that a halide tracer which is larger than the host halide always diffuses with an activation energy which is exactly equal to that for host halide self-diffusion. Author

N70-28770# National Bureau of Standards, Washington, D.C. Analytical Mass Spectrometry Section.
ANALYTICAL MASS SPECTROMETRY SECTION: Summary of Activities, July 1968 to June 1969
William R. Shields, ed. May 1970 58 p refs
(NBS-TN-506) Avail: SOD $0.55

Chemical and mass spectrometric procedures are described for the determinations of the absolute isotopic abundance ratios of natural rubidium, boron in a natural boric acid and a B-10 enriched boric acid, and of uranium in six SRMs. Procedures are also described for the determination of trace amounts of copper and lead in steel, and silver, copper, boron and uranium in glass by isotope dilution mass spectrometry. Author

N70-28797# Joint Publications Research Service, Washington, D.C.
REACTIONS OF EPOXY COMPOUNDS BY A RADICAL MECHANISM
A. P. Maleshevich 12 May 1970 38 p refs Transl. into ENGLISH from Usp. Khim. (USSR), v. 39, no. 3, 1970 p 444-470
(JPRS-50503) Avail: CFSTI

Data pertaining to various methods of initiating radical processes of alpha oxides, including the reactions of homopolymerization of epoxy compounds, are generalized and classified. Author

N70-28807# Harvard Air Cleaning Lab., Cambridge, Mass.
IN-PLACE TEST FOR IODINE REMOVAL SYSTEMS IN NUCLEAR FACILITIES
F. J. Viles, Jr., R. A. Weker, and A. S. Goldin Jan. 1970 46 p refs
(Contract AT(30-1)-841)
(NYO-841-21) Avail: CFSTI

A simple in-place test for filter efficiency in removing iodine has been developed. The test is suitable for field application and has been successfully tested in the field. The test involves passage of stable elemental iodine through the filter, with upstream and downstream sampling on copper beads. Iodine is removed quantitatively by the beads and is recovered from them by washing with ammonium hydroxide. The wash solution is passed through a cation-exchange resin column to remove copper and the iodine is determined in the column effluent by its catalytic effect on the reaction between tetravalent cerium and arsenite. Author (NSA)

N70-28808# Carnegie-Mellon Univ., Pittsburgh, Pa. Radiation Research Labs.
[RADIATION RESEARCH] Quarterly Report, 1 Oct.-31 Dec. 1969
12 Jan. 1970 14 p refs *Its* Fundamental Res. No. 6041
(Contract AT(30-1)-2310)
(RRL-2310-287; Q-50) Avail: CFSTI

Progress is reported on: a steady-state method for measuring electron reaction rates, electron reactions in the gas phase, positive ion reactions of cyclopropane, effects of electron scavengers on the gamma radiolysis of 2,2-dimethylbutane and 2,2,4-trimethylpentane, the thermal hydrogen atom yield in the gamma radiolysis of isooctane, ESR studies in SF6 matrices, spin resonance studies of alcohols during radiolysis, electron trapping in the crystalline state of heterocyclic compounds with large dipole moments, radiation scavenging in aqueous solutions, solvent effects on the stabilities of

Meisenheimer complexes, and micellar effects on the base-catalyzed formation of nitroform from tetranitromethane. NSA

N70-28824# Alexandria Univ. (Egypt).
ELECTRONIC SPECTRA OF SCHIFF BASES. PART 2: N-BENZYLIMINES
M. El-Aasser, F. Abdel-Halim (Michigan State Univ.), and M. Ashraf El-Bayoumi (Michigan State Univ.) 1969 12 p refs
(Contract AT(11-1)-2039)
(COO-2039-4) Avail: CFSTI

Electronic absorption spectra of substituted N-benzylimines have been measured at room temperature in different media. The spectra support interpretations of the spectra of benzanils as being essentially a superposition of the spectra of the corresponding benzal and aniline parts of the molecule. It is shown that the azomethine group acts as an electron acceptor when linked to a phenyl group at its carbon end and as an electron donor when linked to a phenyl group at its nitrogen end. Iodine interaction with N-benzylimine in carbon tetrachloride indicates that the lone pair of electrons on the nitrogen are more available to interact with iodine than in benzylideneaniline. Author

N70-28828# Texas A&M Univ., College Station. Activation Analysis Research Lab.
RESEARCH IN CHARGED PARTICLE ACTIVATION ANALYSIS Progress Report, 1 May 1969 - 31 Jan. 1970
E. A. Schweikert 31 Jan. 1970 41 p refs
(Contract AT(40-1)-3922)
(ORO-3922-1) Avail: CFSTI

Determination of traces of carbon or sulfur by activation methods using protons, deuterons, helium-3, and alpha particles is described. Upper limits of determinations using decay curve analysis and differential analysis are discussed. NSA

N70-28829# Arkansas Univ., Fayetteville. Dept. of Chemistry.
TRACER AND ISOTOPE EFFECT STUDIES IN ORGANIC CHEMISTRY Annual Progress Report
Arthur Fry 1 Feb. 1970 140 p refs
(Contract AT(40-1)-3234)
(ORO-3234-16) Avail: CFSTI

Progress is reported on isotope effect studies, mechanisms of acid-catalyzed rearrangements of carbonyl compounds, N and O exchange studies, and O tracer studies of neighboring group participation in photochemical hydration of double and triple bonds. NSA

N70-28841# California Univ., La Jolla.
SUPERFLUIDITY OF He 3
James Henry Bookbinder Sep. 1969 220 p refs
(Contract AT(11-1)-GEN-10)
(UCSD-10-P-11-90) Avail: CFSTI

The previous treatments of the question of superfluidity in He-3, which have not shown conclusively whether this phase should or should not occur, are summarized. The three approximations involved in Pitaevskii's large-j calculation are studied carefully. Theoretical arguments are given, and numerical evidence is furnished, which indicate that as j increases his limit is being approached asymptotically, but so slowly that Pitaevskii's analytical result does not hold for angular momenta of interest (i.e., for j < 20). The possibility of D-state superfluidity is discussed. The present work indicates that transition temperature may be as high as 10 to the minus 4 deg, but the transition temperature is such a sensitive function of the calculated theoretical parameters that it is difficult to furnish a precise estimate for transition temperature. To make the dissertation self-contained, and to carefully define the notation and terminology, the early chapters contain a summary of many-body techniques, K-matrix theory, and the theory of superconductivity. Author (NSA)

N70-28850# Iowa State Univ. of Science and Technology, Ames.
LOW TEMPERATURE, MATRIX ISOLATION, PHOTOCHEMISTRY: REACTIONS OF SULFUR ATOMS
Mark Noble Davis (M.S. Thesis) Nov. 1969 44 p refs
(Contract W-7405-eng-82)
(IS-T-347) Avail: CFSTI

This research was concerned with an introductory study of the adaptability of a new photochemical method to the elucidation of the reactions of atomic sulfur. The reaction of sulfur atoms with cyclohexene was reported and a detailed identification of the products and mechanism presented. Author

N70-28854# Kernforschungsanlage, Juelich (West Germany). Zentrallab. fuer Chemische Analyse.
VIBRATIONAL SPECTRA AND FORCE CONSTANTS OF COLORED INORGANIC COMPOUNDS [SCHWINGUNGS-SPEKTREN UND KRAFTKONSTANTEN GEFAERBTER ANORGANISCHER VERBINDUNGEN]
W. Krasser (Ph.D. Thesis-Bonn Univ.) Dec. 1969 251 p refs In GERMAN
(JUEL-628-CA) Avail: CFSTI

The registration and assignment of complete vibrational spectra for colored inorganic compounds are considered. The force constants of the chemical bonds and interactions were calculated from these spectra using group theory, and the resulting evidence concerning molecule symmetry is discussed. Measurements of several compounds based on Raman spectra and infrared spectra are also considered. ESRO

N70-28881# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Radiochemie.
LIGAND RECOIL AND SOLID STATE EXCHANGE REACTIONS IN HEXAHALO-COMPLEXES OF Re(IV) AND Ru(III)
R. Bell, K. Roessler, G. Stoecklin, and S. R. Upadhyay Nov. 1969 51 p refs
(JUEL-625-RC) Avail: CFSTI

A systematic investigation of the ligand recoil was made for the hexahalo-complexes of Re(IV) and Rh(III). It is shown that: (1) the chemical state of the thermalized, annealable recoil halogen seems to be X(-), (2) the damage in the vicinity of the thermalized recoil atom, losing its kinetic and electronic energy, should be very small, involving mainly complexes with only one missing ligand, and (3) the most likely type of solid state reaction of the recoil halogen seems to be a jump into a ligand vacancy. However, direct replacement reactions of ligands cannot be excluded as a primary hot process. The annealing reaction seems to be a solid state exchange, proceeding via a three-step process: ligand vacancy formation, migration, and substitution. Author (ESRO)

N70-28895# Michigan State Univ., East Lansing. Dept. of Biophysics.
ANOMALOUS FLUORESCENCE LIFETIMES OF ORGANIC MOLECULES
M. Ashraf El-Bayoumi, Jean-Paul Dalle, and Michael F. O'Dwyer [1969] 18 p refs
(Contract AT(11-1)-2039)
(COO-2039-2) Avail: CFSTI

Anomalously short radiative fluorescence lifetimes were observed for naphthylamines which undergo intramolecular configurational changes upon excitation. The excited state equilibrium configuration has more charge-transfer character than the Franck-Condon state. This makes the transition from the upper state more allowed than calculated from absorption intensities. The radiative fluorescence lifetimes increase with the polarity of the solvent. Such an increase is interpreted in terms of the relaxation of the solvent cage during the lifetime of the excited state, the latter occurs due to dipole moment changes of the solute upon excitation. At low temperatures

when the solvent cage reorientation cannot occur before emission, the emission arises from a Franck-Condon state which has an equilibrium configuration similar to that of the ground state. Under these conditions, the natural fluorescence lifetime shortens and the fluorescence maximum shifts to the blue. Author

N70-28900 Leeds Univ. (England). Dept. of Physical Chemistry.
CRITICAL EVALUATION OF RATE DATA FOR HOMOGENEOUS, GAS PHASE REACTIONS OF INTEREST IN HIGH TEMPERATURE SYSTEMS
D. L. Baulch, D. D. Drysdale, D. G. Horne, and A. C. Lloyd. Dec. 1969. 78 p. refs. Sponsored by Office for Sci. and Tech. Inform. *Its* High Temp. Reaction Rate Data no. 4
Copyright. Avail: Issuing Activity

The UK Office for Scientific and Technical Information has initiated two projects in the University of Leeds, one of them concerned with the establishment of an information center on high temperature processes, and the other with the compilation of critically evaluated kinetic data for reactions of interest in high temperature processes. In this report, which is one of the series from the evaluation project, the rates of a number of homogeneous gas phase reactions have been evaluated. A separate section is devoted to each reaction and, in general, the order of material presented within each section is: (1) thermodynamic data; (2) recommended value of rate constant; (3) Arrhenius plot of available data; (4) discussion; and (5) references. The following reactions are considered: NO + N, N2 + O, O2 + N, NO + O, N + O + M, NO + M, N2 + O2, NO + NO, N2O + O, NO + NO, NO2 + N, and NO + NO. ESRO

N70-28918# National Physical Lab., Teddington (England). Div. of Chemical Standards.
CORRECTION FOR OXIDATION OF NITROGEN IN THE DETERMINATION OF HEAT OF COMBUSTION
Yu. I. Aleksandrov et al. Mar. 1970. 15 p. refs. Transl. into ENGLISH from Trans. of Metrolog. Inst. of USSR, (Moscow), Issue III (171), 1969 p. 95–102
(NPL-DCS-5) Copyright. Avail: CFSTI

A study of the oxidation of nitrogen in a calorimetric bomb established that the end product contains not only nitric acid but nitrogen dioxide as well. By the end of the main period the amount of each component depends upon the initial concentration of nitrogen in the oxygen, the size of the flame during combustion and the flushing time of the bomb with oxygen. The amount of nitric acid formed depends upon the ageing time of the combustion products in the bomb. A procedure for determining the correction for the oxidation of nitrogen, taking into account the incomplete conversion of the oxides of nitrogen into nitric acid, is described. To calculate this correction, it is necessary to determine the amount of nitric acid formed by the end of the main period of a calorimetric experiment and thus establish the amount of nitrogen dioxide present at that time in the gas phase in the bomb. Author (ESRO)

N70-28928# Oklahoma State Univ. Research Foundation, Stillwater.
[VIBRATIONAL SPECTRA AND STRUCTURES OF MOLTEN SALTS: INFRARED (ATR) AND LASER RAMAN SPECTRA] Progress Report
J. Paul Devlin [1969] 15 p. refs
(Contract AT(11-1)-1615)
(COO-1615-6) Avail: CFSTI

Laboratory experiments on infrared and Raman spectra of the glassy mixture of calcium and potassium nitrates are discussed. The results can be characterized as being consistently indicative of a perturbed lattice structure for molten alkali metal nitrates. The concept emerging of the molten salt state is that order is sufficient to support phonon waves and permit the identification of vibrational modes which differ in their phase relationships within unit cells. This requires that such liquids retain vestiges of a lattice structure, but in no sense is the possibility of specific interactions ruled out. Just as for solids, the basic molecular unit may be either a simple, possibly polyatomic, ion or a more complex entity resulting from specific interactions. Author

N70-28930# California Univ., Berkeley. Lawrence Radiation Lab.
MEASUREMENT OF THE KINETICS OF OXIDATION OF MOLYBDENUM BY MEANS OF THE REACTING, ROTATING DISK TECHNIQUE
John L. Schofill, Jr. (Ph.D. Thesis) Nov. 1969. 137 p. refs
(Contract W-7405-eng-48)
(UCRL-19029) Avail: CFSTI

A rotating disk system was developed to study heterogeneous chemical reactions subject to gas phase diffusion limitations. The system was operated at temperatures up to 2000 K and disk speeds up to 15,000 rpm to investigate the reaction of oxygen and molybdenum. The independence of reaction or diffusion on radial position in the rotating disk system permitted kinetic data to be obtained from simple weight loss measurements as a function of disk temperature, oxygen partial pressure, and disk speed. Because of the availability of an exact solution of the diffusion-convection equation for the rotating disk, the diffusional contribution to the overall rate can be accurately assessed when both diffusion and surface reaction offer resistances of comparable magnitude. Author (NSA)

N70-28940# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Reaktorentwicklung.
HEAT TRANSFER IN CHEMICALLY REACTING GASES [WAERMEUEBERGANG IN CHEMISCH REAGIERENDEN GASEN]
Heiko Barnert (Ph.D. Thesis--Tech. Hochsch. Aachen) Feb. 1970. 104 p. refs. In GERMAN
(JUEL-641-RG) Avail: CFSTI

An approximate closed solution for the energy transport in the boundary layers of chemically reacting gases in stationary nonequilibrium conditions is given. The form of the solution is an algorithm, with which statements on the energy transport in the boundary layers of chemically reacting gases, and estimates of the influence of decision parameters can be obtained. Author (ESRO)

N70-28944*# Notre Dame Univ., Ind. Dept. of Chemistry.
EXPLORATORY POLYMER SNYTHESIS Quarterly Report, 1 Feb. – 30 Apr. 1970
G. F. D'Alelio. 30 Apr. 1970. 15 p.
(Grant NGL-004-001)
(NASA-CR-110142; QR-1) Avail: CFSTI CSCL 07C

The prototype monomer, p-xylylidene-2-aminopyridine (DSB), was studied for its potential in the synthesis of polymers of enhanced electrical conductivity. It was found that under certain conditions DSB could be quartenized with dimethylsulfate to form charge-transfer complexes. Derivatives of DSB were prepared and their conductivites at room temperature measured and compared with DSB. The charge-transfer complexes formed included DSB with: Tetracyanoquinodimethan(TCNQ), di-n-methyl-(p-xylylidene-di-2-aminopyridinium)methyl sulfate-Li(TCNQ), and the sodium salt of alpha, alpha-prime dicyano-p-toluoyl cyanide. S.S.

N70-28945# Institut d'Aeronomie Spatiale de Belgique, Brussels. National Research Council of Canada, Ottawa (Ontario).
STRUCTURE OF THE SCHUMANN-RUNGE BANDS FROM O-O TO THE 13-O BAND
M. Ackerman and F. Biaume. 1970. 24 p. refs. Submitted for publication. Prepared jointly with Natl. Res. Council of Can. *Its* Aeronomica Acta No. A-68-1970
Avail: CFSTI

Spectra of the Schumann-Runge bands were photographed at high resolution and the 0-0 band was measured for the first time. Precise values of the vibrational and rotational constants for the 7-0 and 11-0 were determined, and previous results for other bands were confirmed. Author (ESRO)

N70-28956# Mound Lab., Miamisburg, Ohio.
MOUND LABORATORY CHEMISTRY AND PHYSICS Progress Report, Jul. - Sep. 1969
9 Feb. 1970 47 p refs
(Contract AT(33-1)-GEN-53)
(MLM-1609) Avail: CFSTI

The alpha branching ratio of Ac was determined by two independent methods. The intermediate means from the two methods were in good agreement: (1.3802 + or - 0.0069)% and (1.3799 + or - 0.0045)%. The weighted grand mean from 12 determinations was (1.3800 + or - 0.0036)%. A computational technique was developed and tested which is believed to be useful as a nondestructive analytical tool for the determination of Ac by alpha spectrometry in the presence of interfering decay products. A new method of preparing fluorite-type oxide hydrides of gadolinium was developed. The compounds can be prepared by dissolving gadolinium metal in warm, aqueous sodium hypochlorite or in acids such as acetic, propionic or propiolic. Some observations on the chemical stability of these compounds are presented. New facilities for the recovery of uranium-234 from waste plutonium-238 anion exchange raffinates are in operation. The process includes extraction of the uranium with trioctylphosphine oxide, stripping from the organic phase, and purification by anion exchange. NSA

N70-28976# Catholic Univ. of America, Washington, D.C. Dept. of Physics.
STRUCTURAL RELAXATION IN LIQUIDS Progress Report
T. A. Litovitz Feb. 1970 5 p refs
(Contract AT(40-1)-2854)
(TID-25346; PR-9) Avail: CFSTI

The rotational diffusion of molecules in the liquid and solid states are studied by radiation scattering experiments. Both neutron and light scattering data are interpreted on the basis of rotation of single molecules, although in dense systems cooperative rotation is a possibility. It is pointed out that comparison of incoherent neutron data and depolarized light data allows the cooperative nature of molecular rotational diffusion to be verified. The method is applied to the plastic crystal phase of cyclohexane, and it is shown that individual molecules rotate about 10 times as rapidly as the relaxation rate of the mean orientation of a group of molecules. Other investigations include Rayleigh scattering and orientational relaxation in normal alkanes and ultrasonic absorption in liquid metals and liquid metal alloys. Author

N70-28977# Michigan State Univ., East Lansing. Dept. of Biophysics.
FLUORESCENCE LIFETIMES OF MOLECULES THAT UNDERGO LARGE CONFIGURATIONAL CHANGES UPON EXCITATION
M. Ashraf El-Bayoumi, Jean-Paul Dalle, and Michael F. O'Dwyer [1969] 6 p refs
(Contract AT(11-1)-2039)
(COO-2039-5) Avail: CFSTI

Measured natural lifetimes are obtained from fluorescence decay and quantum yield measurements. Calculated natural lifetimes are estimated using the Strickler and Berg relation, which should give suitable natural lifetime values for broad molecular bands when the singlet-singlet transition is strongly allowed and when there are small displacements from the equilibrium nuclear configuration upon excitation. The molecules used to test the validity of the equation were chosen such that they satisfy the two given conditions. Under the limitations, calculated and measured natural fluorescence lifetimes agree reasonably well. Author

N70-28978# Addis Translations International, Woodside, Calif.
TRIMETHYLOLAMINOMETHANE IN MANNICH REACTIONS [TRIMETILOLAMINOMETAN V REAKTSII MANNIKHA]
D. A. Nesterenko et al Sep. 1969 15 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Khim. (Moscow), 1969 Prepared for California Univ., Livermore, Lawrence Radiation Lab.
(UCRL-Trans-10387) Avail: CFSTI

The entry of trimethylolaminomethane into a Mannich reaction with formaldehyde and such electrophilic components as nitroform, fluorodinitromethane, and 1,1-dinitroethane, after nitration at the O and N, could result in high-energy compounds. Preliminary tests show that trimethylolaminomethane does not form condensation products with formaldehyde and nitroalkanes which possess active hydrogen, possibly due to strong intramolecular hydrogen bonding in the beta-amino-alcohols determining the molecular conformation. In the trimethylolamino-methane molecule the three hydroxymethyl and one amino group on the same carbon are assumed to set up a system of hydrogen bonds such that the reaction center in the Mannich reaction is blocked. The hydroxyl groups were etherified to make trimethylolaminomethane enter a Mannich reaction. Author

N70-29047# Argonne National Lab., Ill. Chemistry Div.
EFFECT OF ANIONIC CONSTITUENTS ON THE SURFACE IONIZATION OF LITHIUM SALTS
Eric N. Sloth (Ph.D. Thesis—IIT, Chicago) Jul. 1969 130 p refs
(Contract W-31-109-eng-38)
(ANL-7594) Avail: CFSTI

The validity of the Saha - Langmuir theory of surface ionization was demonstrated for the lithium - rhenium system over a temperature range 1200 to 2600 K. The effective surface-ionization work function obtained for rhenium is 5.21 + or - 0.01 eV, compared to the measured thermionic-emission work function of 4.98 + or - 0.03 eV. At relatively high temperatures, the temperature dependence of the lithium surface-ionization current from all molecules studied is identical to that obtained from lithium atoms. Incomplete dissociation of lithium chloride and lithium bromide can account for the lithium ionization threshold temperatures being well above that for surface ionization of lithium atoms. Enhanced emission of lithium ions was observed in the temperature range where incomplete dissociation of lithium iodide was expected due to a rhenium - iodine interaction shifting the dissociation equilibrium to lower temperatures. Lithium sulfate decomposed to give beams of dilithium oxide and lithium atoms. Author (NSA)

N70-29082# Oak Ridge National Lab., Tenn.
ANALYTICAL CHEMISTRY DIVISION Annual Progress Report, Period Ending 31 Oct. 1969
Helen P. Raaen, comp. Jan. 1970 187 p refs
(Contract W-7405-eng-26)
(ORNL-4466) Avail: CFSTI

The research projects of an analytical chemistry division are presented. Subjects discussed are (1) analytical instrumentation, (2) analytical methodology, (3) analytical chemistry for reactor projects, (4) analytical biochemistry, (5) methods development and evaluation, (6) mass spectroscopy, (7) X-ray and optical spectroscopy, (8) nuclear and radiochemistry, and (9) inorganic preparations. Author (NSA)

N70-29083# Brookhaven National Lab., Upton, N.Y.
OZONE SYNTHESIS FOR WATER TREATMENT BY HIGH ENERGY RADIATION
Meyer Steinberg and Morris Beller Jul. 1969 36 p refs Presented at the 62d Ann. Meeting on Waste Treatment Appl. of Radiation Chem., Washington, D.C., 16-20 Nov. 1969; sponsored by AEC
(BNL-13812; CONF-691108-1) Avail: CFSTI

The use of ozone in tertiary treatment of secondary waste effluent is briefly reviewed. The high energy radiation synthesis and the electric discharge synthesis of ozone are compared. The results of basic radiation chemistry studies and tests indicate that G-values for ozone production from oxygen in a high pressure production facility can range between 10 and 15. These energy yields are at least 2 to 3 times higher than are obtained by the electric discharge process. Isotopic radiation sources can mainly be considered for treating drinking water or for smaller quantities of sewage effluent. The fission fragment chemonuclear process has a distinct economic advantage over all other systems, including the electric discharge process, in the high capacity range, producing hundreds of tons of ozone per day. Conceptual design and cost estimates of the chemonuclear process are presented. Author (NSA)

N70-29090# Kentucky Univ., Lexington. Dept. of Chemistry.
A NORMAL COORDINATE ANALYSIS OF BORAZINE
Kenneth E. Blick and Kurt Niedenzu Dec. 1969 29 p refs
(Contract DAAB07-69-C-0366; Proj. Themis)
(AD-701704; THEMIS-UK-RR-5) Avail: CFSTI CSCL 7/4

Utilizing a recent reassignment of the vibrational spectrum of borazine, (-BH-NH-)3, and isotopically labeled derivatives thereof, a normal coordinate analysis on this six-membered heterocycle has been performed. The calculated valence force field was adjusted to provide a reasonable fit for all of the available data. Initial calculations suggested the reassignment of one fundamental and also indicated that one of the seventeen observable normal vibrations could not be rigorously identified. When the entire set of suggested assignments for the normal vibrations of (-BH-NH-)3, (-10BH-NH-)3, (-BH-ND-)3, (-10BH-ND-)3, (-BD-NH-)3, (-10BD-NH-)3 and (-BD-ND-)3 was utilized in a simultaneous least-squares adjustment, the average error between all of the calculated and observed frequencies was 1.95%. The calculated force constants are in agreement with recent judgments on the strength of the various bonds in the borazine molecule. The calculated potential energy distribution of the isotopically labeled derivatives indicates that the character of several BH and NH vibrations is altered substantially upon deuteration at either the boron or the nitrogen atoms. Displacements calculated for the parent borazine molecule reveal appreciable movement of the annular atoms out of the molecular plane. Author (TAB)

N70-29103*# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
FAR INFRARED ABSORPTION IN LIQUEFIED GASES
M. C. Jones Apr. 1970 43 p refs
(NASA Order R-45)
(NASA-CR-110130; NBS-TN-390) Avail: SOD $0.50; CFSTI CSCL 07D

Experimental results are given for the absorption coefficient of the liquids hydrogen (three para concentrations), nitrogen, oxygen, carbon monoxide, methane and argon in the wavenumber range 40-500 micrometers. In addition, data for liquid hydrogen are given at wave numbers up to 16.7 micrometers. The results are discussed in terms of the induced dipole, and, in the case of carbon monoxide, the permanent dipole. An indication of the way in which the data may be employed in calculations of thermal radiative transfer is made by calculation of the modified Planck mean absorption coefficient. Author

N70-29121# California Inst. of Tech., Pasadena. Div. of Chemistry and Chemical Engineering.
STRUCTURE OF SIMPLE FLUIDS Final Report, 1959 - 1969
C. J. Pings Feb. 1970 20 p refs
(Contract Nonr-220(40))
(AD-701360) Avail: CFSTI CSCL 7/4

A brief review is given of research on the liquid state of metals, x-ray diffraction studies of liquid metals, liquefied gases, and organic liquids. The resulting publications are listed. TAB

N70-29139# Colorado State Univ., Fort Collins. Dept. of Chemistry.
CHEMICAL EFFECTS OF THE NUCLEAR REACTION N-14(n,p)C-14 IN VARIOUS NITROGENOUS COMPOUNDS Progress Report, 1 May 1969 - 30 Apr. 1970
John D. Vaughan 15 Jan. 1970 15 p refs
(Contract AT(11-1)-1620)
(COO-1620-4) Avail: CFSTI

The chemistry of recoil carbon-14 produced by pile irradiation of crystalline compounds containing nitrogen was studied. Two methods of target dissolution were used in experiments with KN3. In the first, target samples with or without post-irradiation treatment were dissolved in water. In the second, target samples were heated and held at 400 C for 2 to 3 hours, leading initially to melting and subsequently to decomposition of KN3. Distribution of activity among the products is tabulated. The protective role of carriers in the melt is noted. NSA

N70-29141# Utah Univ., Salt Lake City. Dept. of Chemistry.
RELAXATION METHOD RATE STUDIES OF ULTRA-RAPID CHEMICAL REACTIONS IN SOLUTIONS Interim Report, 1 Jul. - 31 Dec. 1969
Edward M. Eyring 31 Dec. 1969 17 p refs
(Grant AF-AFOSR-1717-69)
(AD-701436; AFOSR-170-0429TR) Avail: CFSTI CSCL 7/4

The pertinence of rapid metal ion hydrolyses and polymerizations to the problem of corrosion is discussed. Recent kinetic studies of the dimerization of aqueous hydrolyzed gallium (III) and of indium (III) perchlorate are then compared with Wendts model. While the data do not disprove the hypothesis that first coordination sphere water loss from MOH(2+) is rate determining, they do suggest that the reactant species are less highly charged than had been inferred. Progress on the construction of a large Q-switched neodymium laser temperature apparatus is also discussed with photographs and diagrams. Author (TAB)

N70-29165# Illinois Univ., Urbana.
PREPARATION OF C-14 AND TRITIUM LABELED COMPOUNDS BY HYDROBORATION AND TRITIOBORATION PROCEDURES Technical Progress Report, 1 May 1969 - 30 Apr. 1970
30 Apr. 1970 9 p refs
(Contract AT(11-1)-890)
(COO-890-11) Avail: CFSTI

The pyrolytic radiogas chromatography technique was used to determine the position or positions of carbon 14 labeling of a radioactive aliphatic alcohol in milligram quantities or less with analysis times of less than one hour. A preliminary study of the palladium catalyzed exchange reaction between organoboranes and deuterium gas in the absence of solvent yielded highly deuterated products. A new method for generating diborane on a 5 millimole scale or less by reaction between iodine and sodium borohydride in diglyme was developed. Tritiated diborane was prepared by heating diborane with tritium gas at 80 deg for 3 hours. NSA

N70-29180*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE Mg(2+)-Fe(2+) ORDER-DISORDER AND THE THERMODYNAMICS OF THE ORTHOPYROXENE, (Mg, Fe)2Si2O6 CRYSTALLINE SOLUTION. PART 1: A Fe 57 MOESSBAUER RESONANCE STUDY OF THE Mg(2+)-Fe(2+) DISTRIBUTION IN ORTHOPYROXENES AT 500, 600, 700 AND 800 C
Surendra K. Saxena and Subrata Ghose May 1970 36 p refs
(NASA-TM-X-63936; X-644-70-197) Avail: CFSTI CSCL 07D

The experimental data on the distribution of Mg(2+) and Fe(2+) between M1 and M2 sites in orthopyroxenes heated at various temperatures as determined by the Mossbauer resonance

technique were found to yield smooth distribution isotherms, which are in better agreement with distribution curves based on Guggenheim's simple mixture model, rather than the ideal solution model for the sites. The deviation from the ideal solution model increases with decrease in temperature. Mixing of Mg(2+) and Fe(2+) on the M1 site was found to be more non-ideal than that on the M2 site. The success of such a model explains the apparent inconsistencies in the interpretation of the Mg-Fe distribution data by Virgo and Hafner who tried to fit the ideal solution model at the sites. However, the non-ideal distribution in part of the 1000 C isotherm does not agree with the present model. The expected WM1 and WM2 values for 1000 C are quite small and the distribution curve approaches closely to that of the ideal model. The close to ideal behavior would be true for the entire composition range and not only a part of it. In view of this discrepancy, a redetermination of the 1000 C isotherm is highly desirable. Author

N70-29187# Rensselaer Polytechnic Inst., Troy, N.Y.
PULSE RADIOLYSIS OF GASES: N2-NO AND He-N2 SYSTEMS
P. Rushbrook, S. Dondes, and P. Harteck. 15 Jan. 1970 196 p refs
(Contract AT(30-3)-3821)
(RPI-3821-4) Avail: CFSTI

The pulse radiolysis technique was applied to gas mixtures of nitrogen - nitric oxide and helium-nitrogen. The source of radiation was a pulsed 1-MeV Van de Graaff electron accelerator with a power output of 0.5 joules per pulse, and a pulse width of 0.000005 seconds. The primary band systems that appeared in the gross spectra of many of the mixtures were the NO(gamma), N2 2nd positive and N2(+) 1st negative systems. Other bands and lines also appeared, which were due to minute impurities in the mixtures. The specific band systems studied in both gas mixtures, with the available instrumentation, were the NO(gamma) and the NH 3360 A systems. Both were persistent bands, and appeared under a wide range of conditions. All the observed decays followed first order kinetics: the half-lives varied inversely with the NO concentration in the N2 - NO mixtures and inversely with the nitrogen concentration in the He - N2 mixtures. Author (NSA)

N70-29190# Michigan State Univ., East Lansing. Dept. of Chemistry.
NUCLEAR QUADRUPOLE RESONANCE ZEEMAN STUDIES OF p-BROMOBENZENESULFONYL CHLORIDE AND p-BROMOANILINE HYDROCHLORIDE
K. V. S. Rama Rao and Max T. Rogers [1969] 14 p refs
Sponsored in part by AEC and by Am. Chem. Soc. Petrol. Res. Fund
(COO-1385-28) Avail: CFSTI

An NQR Zeeman study of Br-79 in p-bromobenzene sulfonyl chloride and p-bromoaniline hydrochloride was carried out at room temperature. The principal field gradient directions and asymmetry parameters were determined. The data were used to estimate the double bond character of the C-Br bond in these molecules and the results were compared with previously reported values for various para substituted bromobenzenes. Author

N70-29193# Weizmann Inst. of Science, Rehovoth (Israel).
THE MECHANISM OF NITROGEN FIXATION UNDER ULTRASONIC RADIATION IN WATER Scientific Report, 1 Jun. 1965 - 31 Dec. 1967
Michael Anbar. Dec. 1969 6 p refs
(Grant AF-EOAR-67-65)
(AD-701439; AFOSR-70-0310TR) Avail: CFSTI CSCL 7/2

Research covering a two year period is briefly discussed. Basically it delt with the sonolysis. Molecular fragmentation of organic liquids was produced by cavitation due to ultrasound waves, even in the absence of water. The sonolysis of acetonitrile under argon yielded N2, CH3, and H2. Excited singlet oxygen molecules in solution were shown to be formed in the reaction of H2O2 with HOCl (or Cl2) or with alkaline pyrogallol. The formation of OH radicals under sonolysis has been investigated by following the oxidative deamination of ethylenediamine. TAB

N70-29196# Army Electronics Command, Fort Monmouth, N.J.
SYNTHESIS AND CHARACTERIZATION OF INTERMEDIATE COMPOUNDS INVOLVED IN THE ELECTROCHEMICAL REDUCTION OF m-DINITROBENZENE
Johnny M. Walbrick. Feb. 1970 24 p refs
(AD-701879; ECOM-3222) Avail: CFSTI CSCL 7/3

The mechanism for the electrochemical reduction of m-dinitrobenzene is discussed, with special attention being placed upon the pH dependence of the reduction. The synthesis and characterization of several of the intermediate compounds involved in the postulated reaction sequence are described. Compounds included in this were m-dinitrobenzene, m-nitronitrosobenzene, m-nitrophenylhydroxylamine, m-nitroaniline, m,m-dinitroazoxybenzene, m,m-dinitroazobenzene, and m-phenylenediamine. Author (TAB)

N70-29198# Army Weapons Command, Rock Island, Ill. Science and Technology Lab.
SYNTHESIS OF POLYETHER-MODIFIED POLYCARBONATE ELASTOMERS
Richard A. Faoro. Dec. 1969 20 p refs
(AD-701875; TR-70-115) Avail: CFSTI CSCL 7/3

Block copolymers based on polyether polyols and compounds related to the bisphenol structure were synthesized by copolycondensation with phosgene. Elastomers were obtained from the copolycondensation of hydroxy terminated polyethers with phenolphthalein, diphenolic acid or derivatives of diphenolic acid. These elastomers were crosslinked with sulfur and peroxide curing systems, and exhibited tensile strengths up to 2250 p.s.i., 13 percent volume swell after immersion in ASTMN 0.3 Oil for 70 hours at 212 F, and flexibility at temperatures below -67 F. Author (TAB)

07 COMMUNICATIONS

Includes communications equipment and techniques, noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N70-27831# Naval Research Lab., Washington, D.C. Space Science Div.
THE EFFECT OF SEA ROUGHNESS ON THE BANDWIDTH OF RADAR BACKSCATTER Final Report
D. L. Hammond. 2 Feb. 1970 12 p refs
(AD-702395; NRL-6996) Avail: CFSTI CSCL 17/9

The doppler signals of an 8-mm aircraft radar navigation system were analyzed to determine the effect of sea roughness on the bandwidth of the radar backscatter. The ground truths giving the wave heights were obtained by estimates made by the scientist aboard the aircraft and by hindcasts of the sea conditions based on weather records. The results are given in terms of a factor called Q which varies inversely with bandwidth and is independent of aircraft altitude and velocity. When the data are arranged in the order of increasing wave heights, there is a trend of increasing Q with increasing wave height. That is, the bandwidth increases as sea roughness increases. Author (TAB)

N70-27841# Hughes Aircraft Co., Culver City, Calif.
DESIGN OF AN AIRBORNE HELMET MOUNTED DISPLAY Final Report, Jun. – Sep. 1968
J. L. Heard, D. O. Hayes, J. J. Ferrer, and A. Zilgalvis Sep. 1969 46 p
(Contract F33615-68-C-1657)
(AD-701385; AMRL-TR-68-181) Avail: CFSTI CSCL 17/2

The report describes the laboratory tests and design studies accomplished for the preliminary design of an airborne Helmet Mounted Display (HMD). The HMD design allows the airborne simulation of several sizes of TV displays. By changing the optics used in the HMD, apparent display sizes from 6 inches to 22 inches can be provided at an apparent viewing distance of 18 inches. Five sets of interchangeable optics can be changed inflight to provide the various display sizes. A high resolution CRT provides a high quality TV picture under all magnification conditions. The headset is designed to be easily installed, adjusted and removed in-flight from either the Navy or Air Force standard helmet. An electronics unit with operator controls drives the headset. The HMD is designed to operate with either 575 or 875 line TV input, 30 Hz frame rate and 2:1 interlace. Author (TAB)

N70-27956# Stanford Univ., Calif. Stanford Electronics Lab.
CODED FREQUENCY SHIFT KEYED SEQUENCES WITH APPLICATIONS TO LOW DATA RATE COMMUNICATION AND RADAR Technical Report
Michael Jon Sites Sep. 1969 111 p refs
(Contract Nonr-225(83))
(AD-702063; TR-3606-5; SU-SEL-69-033) Avail: CFSTI CSCL 9/4

Coded discrete frequency sequences can provide greatly improved performance over conventional techniques when the fluctuation bandwidth of the communication channel is a significant fraction of the transmission bandwidth. These fluctuations result from medium, equipment, and, in the case of radar, random target variations. The ability to reliably detect these sequences under frequency shift is investigated using a simple algorithm to calculate an approximation of the true ambiguity function. This investigation leads to certain necessary conditions and a set of coupled equations which permit a sequence to be synthesized from the ambiguity function approximation. Error rates for CFSK sequences are calculated and criteria for optimizing the performance in rapidly fluctuating channels given. An algorithm for constructing sets of orthogonal sequences with desirable cross-ambiguity properties is developed and the performance of these sets of orthogonal sequences compared with binary code alphabets. Finally, consideration is given to digital and analog implementations of the special receiver required for the CFSK sequences, error correction coding problems associated with M-ary encoding, and acquisition behavior. Author (TAB)

N70-27990*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LUNAR ORBITER PROJECT SUPPORT
In its Tracking and Data System Support for Lunar Orbiter 15 Apr. 1970 p 1–40 (See N70-27989 14-31) Avail: CFSTI CSCL17B

The activities of the tracking and data system (DS) supporting the Lunar Orbiter Project are summarized. Project requirements and commitments are compared with actual coverage and performance. Data quality and data recovery percentage for the lunar orbiter missions were analyzed during near earth phase support and deep space network support. Major facility changes during the project, TDS failure reporting system, mission support man hours, and facility loading are also reviewed. J.A.M.

N70-28010# Washington Univ., Seattle. Dept. of Electrical Engineering.
OPTIMUM SCATTERING FROM AN ARRAY OF HALF-WAVE DIPOLES
Richard J. Coe and Akira Ishimaru Oct. 1969 33 p refs
(Contract F19628-68-C-0126)
(AD-700407; AFCRL-69-0476; SR-4; TR-135) Avail: CFSTI CSCL 20/14

Optimization of the field scattered by an antenna has important application in radar systems and as elements in passive communication links. A method is given for optimizing the scattering from a linear array of half-wavelength dipoles at a prescribed bistatic angle. The array is excited by a plane wave incident at an arbitrarily specified angle. The field scattered by the array is maximized or minimized as a function of the parameters of a network connected to the accessible minimized as a function of the parameters of a network connected to the accessible antenna terminals. The result is a matrix eigenvalue equation of order 1/2M(M-1) for the optimum parameters of an M element array. Passive solutions are constructed which yield a prescribed zero in the bistatic scattering pattern. The corresponding network can then be realized using existing network synthesis procedures. The essential features of the theory are illustrated by synthesizing an optimum network for a two element array. It is also shown that backscatter at any angle can be minimized independently of the receiving pattern of the array. Author (TAB)

N70-28014# Singer-General Precision, Inc., Pleasantville, N.Y. Kearfott Div.
HELIUM SPEECH INVESTIGATIONS Final Technical Report, Mar. 1968 – Nov. 1969
Robert A. Flower 10 Dec. 1969 75 p refs
(Contract N00014-68-C-0330)
(AD-702119) Avail: CFSTI CSCL 17/2

The essential steps for correction of helium speech distortions are: providing bandwidth to 10 KHz, providing adequate compensation for loss of vocal output in the 2-8 KHz range, and reducing spectral envelope frequencies (e.g., the formant bands) to normal values while preserving the glottal rate of the talker. A helium speech translator based on these principles has been developed and tested. Both taped stimuli and real-time operation during dives were used for evaluation purposes. Highly successful performance was demonstrated with divers at pressure depths as great as 1000 feet. Objective word intelligibility test results were 88% at 500 feet and 78 at 800 feet, as compared with previously reported intelligibility of 5% for uncorrected helium speech at a depth of 600 feet. Author (TAB)

N70-28060*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
DEVELOPMENT OF CIRCUITRY FOR A MULTIKILOWATT TRANSMITTER FOR SPACE COMMUNICATIONS SATELLITES Interim Technical Report
20 Feb. 1970 185 p refs
(Contract NAS8-24771)
(NASA-CR-102688) Avail: CFSTI CSCL 17B

This effort reported is a continuation of a previous study on definition of space transmitters with emphasis on space TV broadcast satellites. Development of about half of the transmitter was performed during the reporting interval. Of the transmitter circuits, initial development is complete for a 125 watt visual channel driver at 825.25 MHz and nearly complete for a 500 watt FM aural channel amplifier at 829.75 MHz. A crowbar circuit for dc breakdown protection has been bench tested and will be included in the final transmitter assembly. Also, RF waveguide components have been completed for inclusion in the transmitter tests. An initial approach has been selected for the high efficiency Doherty UHF visual channel amplifier, and a controlled carrier circuit has been designed to achieve dc power conservation in the AM TV application. Test plans have been prepared for the transmitter tests and also for testing selected RF waveguide and coaxial components in a vacuum environment to assess electrical breakdown potential. Author

N70-28085*# Houstin Univ., Tex.
INFLUENCE OF BANDWIDTH RESTRICTION ON THE SIGNAL-TO-NOISE PERFORMANCE OF A MODULATED PCM/NRZ SIGNAL, PART 2 Final Report
N. M. Shehadeh and Man Sang Wong 11 Mar. 1970 93 p refs
(Contract NAS9-9270)
(NASA-CR-108451) Avail: CFSTI CSCL 17B

The influence of premodulation filtering on the relationship between signal-to-noise ratios and bit-error probability of a PCM/AM/NRZ signal fed to a detector that integrates the signal over a bit period is investigated by mathematically analyzing the overall system to show the results of signal bandlimiting, modulation, demodulation, and optimim detection. A step-by-step explanation of system design and construction is given. System synchronization and integrate-and dump techniques are emphasized. A statistical analysis on data reliability is presented. Author

N70-28088*# TRW Systems Group, Redondo Beach, Calif. Telecommunications Dept.
L-BAND PHASE-LOCK RECEIVER Final Report
R. V. Salcedo Jan. 1970 74 p ref
(Contract NAS12-539)
(NASA-CR-86353; TRW-08710-6029-R0-00) Avail: CFSTI CSCL 17B

This technical report documents the results to design, fabricate, test, and deliver a breadboard model of an L-band, phase-lock receiver. The receiver is designed to be used in vehicles employing an operational navigation satellite system, although the receiver could be adapted quite easily for a number of applications. To meet the requirements of this project, the receiver is designed to employ automatic acquisition, tracking, and bandswitching. Additionally, the L-band, phase-lock receiver has been integrated and tested with the BINOR digital processor. Microelectronics is used extensively in this receiver to achieve low cost and high reliability. Microminiaturization is also used in some of the low-frequency circuits, such as the VCXO, reference oscillator, and second mixer. The balance of the circuitry is implemented with integrated circuits. Modular packaging is used for the breadboard receiver with the modules attached to an aluminum chassis. Interconnections are made with coaxial cabling. Author

N70-28218# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
UNSUPERVISED ESTIMATION AND PROCESSING OF UNKNOWN SIGNALS Technical Report, Feb. 1968 - Jun. 1969
E. A. Patrick and J. P. Costello Griffiss AFB, N.Y. RADC Feb. 1970 211 p refs
(Contracts F30602-68-C-0186; F33615-68-C-1577)
(AD-702465; TR-EE69-18) Avail: CFSTI CSCL 9/4

Many communications systems, sonar and radar systems, control systems and pattern recognition systems such as biomedical signal processing systems must partition a multidimensional sample space so that decisions can be made on the underlying active source events. Unfortunately, the a priori information necessary to construct an acceptable partition is not always available. For many problems estimation using samples of unknown classification is the only source of additional knowledge on the sample space statistical structure. Since the sample classifications are unknown, these estimators are called unsupervised estimation algorithms. This research is concerned with investigating practical approaches to the unsupervised estimation problem which are in some sense optimum. The emphasis is on recursive estimation algorithms having fixed storage requirements and on sequential sample processing. A Bayesian framework is utilized as a guide towards optimality, and to provide a unifying relationship for the approaches of the report. The relationship between Bayes a posteriori, stochastic approximation, and decision directed approaches is determined. It is shown, for example, that an optimization criterion derived from the Bayes approach can be used to relate maximum likelihood-related stochastic approximation algorithms with decision directed estimators. The application of unsupervised estimation algorithms to a practical problem is illustrated using the problem of intersymbol interference. Author (TAB)

N70-28255# Illinois Univ., Urbana. Antenna Lab.
THE DIFFRACTION OF ELECTROMAGNETIC WAVES BY DIELECTRIC STEPS IN WAVEGUIDES
Erlind G. Royer and Raj Mittra Jan. 1970 87 p refs
(Contract F19628-69-C-0015)
(AD-702139; UIAL-70-1; AFCRL-70-0070; Rept-4) Avail: CFSTI CSCL 20/14

The problem of determining the scattered electromagnetic fields when a dielectric step discontinuity is placed in a waveguide is considered here. The case of a dielectric step which is semi-infinite in extent is presented first. Although an exact method of solution is not known at this time, it is shown that the recently introduced modified residue calculus technique can be successfully extended to obtain a very accurate approximate solution of the semi-infinite dielectric step. A unique advantage of this method of solution is that the degree of accuracy obtained is independent of the relative permittivity of the dielectric material and of the frequency. Thus, very high permittivities of frequencies can be considered without an attendant increase in computational complexity. Numerical data are presented which confirm the accuracy of the solutions obtained. The accurate determination of the total field is easily accomplished using the method of this study and is demonstrated. A further extension of the modified residue calculus method yields the approximate solution for the case of a finite dielectric step. This extension also enjoys the advantages mentioned above. The phase shifting abilities of the finite step are demonstrated by calculations which show the effects of varying the step height and the step length. Author (TAB)

N70-28342# RAND Corp., Santa Monica, Calif.
ALTERNATIVE TECHNOLOGIES FOR INFORMATION NETWORKS
J. A. Farquhar and J. A. Dei Rossi Dec. 1969 9 p refs Presented at the Conf. on Image Storage and Transmission Systems for Libraries, Natl. Bureau of Standards, Gaithersburg, Md., 1-2 Dec. 1969
(AD-699830; P-4272) Avail: CFSTI CSCL 5/2

The paper concerns some of the economic considerations inherent in designing user services that incorporate various communication systems. It describes three such services considered important in providing information to the biomedical community comprised of practicing physicians and those engaged in teaching and research, as well as other professionals directly involved in biomedical research and in the practice of medicine. Following this discussion is a brief description of some technological developments that might make these or similar services available in less expensive ways, as well as some problem areas. Author (TAB)

N70-28432*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
ANALYSIS OF A HYBRID PHASE-LOCK LOOP
Thomas L. Stewart Washington Jun. 1970 21 p refs
(NASA-TN-D-5666; C-101) Avail: CFSTI CSCL 17B

A model for a hybrid phase lock loop has been derived by using Fokker-Planck techniques. The hybrid loop operates on both the data and carrier components of the received signal to provide the phase estimate required for coherent detection. The loop is optimized with respect to the system design parameters, and the performance of a bipolar phase shift keyed communication system is evaluated. The results are compared with systems which employ Costas-type loops or conventional phase lock loops. The hybrid loop gives superior performance for all signal to noise ratios, with

a maximum improvement of 1.5 dB for low data rate systems, and, additionally, is satisfactory over a wider range of signal to noise ratios than either the Costas or conventional phase lock loops. Author

N70-28457# Geonautics, Inc., Falls Church, Va.
DATA COLLECTION AND ANALYSIS TECHNIQUES FOR A PLANNED EXPERIMENTAL HARBOR ADVISORY RADAR (HAR) SYSTEM Final Report
Dec. 1969 69 p
(Contract DOT-CG-93175-A)
(AD-702505) Avail: CFSTI CSCL 17/9

In their continuing efforts to improve navigational aids for the maritime community, the U. S. Coast Guard is establishing an experimental Harbor Advisory Radar (HAR) system at the port of San Francisco, California. The system consists of an X-Band radar installed on Yerba Buena Island with the necessary micro-wave link to transmit the radar data to the Control Center at Pier 45, San Francisco. The Control Center will contain the necessary communication, display and recording equipment required to provide the advisory service and record experimental data. The Control Center will be located adjacent to, and will operate in conjunction with, the Vessel Movement Reporting System (VMRS) currently operated by the Marine Exchange, a commercial organization. The HAR will not direct or control the movement of vessels in the San Francisco Bay Area other than Coast Guard vessels used in the experiment. It will provide advice only to the masters and pilots who control the movements of vessels. In order to determine the practical application of HAR, the Coast Guard will operate the systemo on an experimental basis for a minimum period of six months, commencing about 5 December 1969. This report describes techniques and methods for data collection, and the development or programs and procedures necessary for the analysis of the data to be collected. Author (TAB)

N70-28484*# Research Triangle Inst., Durham, N.C.
A STUDY OF THE CAPABILITIES OF THE GEODETIC SATELLITE ALTIMETER TO MEASURE OCEAN-SURFACE CHARACTERISTICS Final Engineering Report
Apr. 1970 184 p refs
(Contract NASw-1909)
(NASA-CR-110085) Avail: CFSTI CSCL 17I

The results of an eight-month study of signal processing techniques applicable to the Geodetic satellite altimeter program is presented. Analysis of random errors in the altitude measurement process which arise from signal fluctuations and receiver noise is discussed. Results are presented based on both theoretical analyses and computer simulation of the altimeter concept. Characteristics of the electromagnetic energy scattered from the ocean surface are then discussed from the standpoint of identifying statistical properties of the altimeter signal and for identifying measurement biases that may arise in the scattering process. A discussion of the presently known oceanographic factors pertaining to the scattering problem concludes the report. Author

N70-28535*# General Electric Co., Philadelphia, Pa. Space Systems Organization.
MULTIKILOWATT TRANSMITTER STUDY FOR SPACE COMMUNICATIONS SATELLITES, VOLUME 2
30 Jul. 1969 255 p refs
(Contract NAS8-21886)
(NASA-CR-102593) Avail: CFSTI CSCL 17B

A comparison study of high-efficiency amplifiers was continued with two AM, high-efficiency amplifier circuits. The Doherty was selected over the Chireix Outphasing for breadboarding on the basis of apparent less complexity. Three low-power breadboard configurations are described: a UHF interdigital cavity type, a UHF 2-cavity amplifier, and a 30-MHz discrete-component simulator. The latter two provided good Doherty operation, but require further optimization effort to achieve the maximum efficiency. The supporting technology areas studied included monitor and protective circuitry for both dc and RF subsystems, thermal control design approaches for the transmitter and power conditioner, and approaches for space qualification of high-power transmitter tubes. In addition, a qualitative evaluation of the validity of scaling low-power experimental and analytical results to a high-power level indicated caution should be exercised where electrical breakdowns may be encountered, since some phenomena are not predictable due to the lack of pertinent data. Author

N70-28630# Grumman Aircraft Engineering Corp., Bethpage, N.Y. Research Dept.
ENHANCEMENT OF LOW SPATIAL FREQUENCY SIGNALS WITH OPTICAL APERTURE TAPERING
B. J. Pernick, S. Levinson, and C. Bartolotta May 1970 36 p refs Submitted for publication
(RE-382J) Avail: CFSTI

Detection of weak signals in an optical spectrum analyzer is impaired by sidelobes from nearby large signal components in the output spectrum. Strong sidelobes about the zero frequency component particularly inhibit detection of low frequency signals. Sidelobe response can be attenuated by suitable illumination tapering over the input data aperture. Changes of first and second sidelobe levels and main lobe width have been investigated for Gaussian, Lorentzian, and exponential tapers. Improved capability to distinguish weak low frequency signals in the presence of distortions introduced by component flaws is demonstrated for the exponential form. Author

N70-28663# Grumman Aircraft Engineering Corp., Bethpage, N.Y. System Sciences Section.
ON THE RESOLUTION OF FINITE APERTURE ANTENNAS IN RADAR SYSTEMS
M. R. Wohlers Apr. 1970 15 p refs
(RM-471) Avail: CFSTI

Two uniqueness theorems are presented. The first states that the magnitude-integrable time-varying electromagnetic fields at all points inside a bounded homogeneous isotropic dielectric are uniquely determined by the time-varying tangential component. The second, or source, uniqueness theorem states that when some of the sources of the fields are embedded within an otherwise homogeneous isotropic dielectric, then these sources are also uniquely determined by the behavior of the fields on any closed mathematical surface. This result implies, for example, that the size of the aperture of the receiving antenna in a radar system does not place any fundamental limitation on the resolution capability of the system. Author

N70-28740*# Lockheed-Georgia Co., Marietta.
CONFORMAL PHASED ARRAY ANTENNA STUDY
M. J. Moss and D. O. Noneaker Apr. 1970 153 p refs
(Contract NAS12-2156)
(NASA-CR-86389) Avail: NASA Scientific and Technical Information Facility, P. O. Box 33, College Park, Md. 20740 CSCL 17I

An investigation of an airborne hazard avoidance system is described including an overall requirements analysis and the feasibility of using a conformal phased array antenna for satisfying selectively chosen requirements. The baseline aircraft for a large part of the study was an advanced supersonic transport, although other aircraft such as subsonic jumbo-jet air transports were considered. The requirements of the hazard avoidance system were characterized by function along each of the flight path segments to enable the selection of a consistent set of system operating parameters. The functions include weather detection, high-resolution approach ground mapping, enroute navigation ground mapping, proximity ground warning, and pilot warning indication. The

parameters defined by these functions include frequency of operation, power levels, range, modes of operation, and computer control system. The effects of high altitude microwave attenuation and ray diffraction on the performance of the hazard avoidance system were examined through the use of computer simulation programs. Difficulties created by contradictory demands were resolved by performing trade-off analyses, which determined the basic requisites of the conformal phased array antenna system. Author

N70-28759*# Radio Corp. of America, Princeton, N.J.
INVESTIGATION OF LINE-OF-SIGHT PROPAGATION IN DENSE ATMOSPHERE, PHASE 1 Final Report, Mar. 1969 - May 1970
D. A. deWolf and J. W. Davenport May 1970 40 p refs
(Contract NAS2-5310)
(NASA-CR-73440) Avail: CFSTI CSCL 20N

An analysis was made of the turbulence-induced fluctuations in refractive index in the Venusian atmosphere. These fluctuations, which are spatially inhomogeneous, are shown to scatter radio waves and lead to signal fading and attenuation on line-of-sight paths. From estimates of the strength of the turbulence obtained with the aid of Venera-4 data, radiowave fading was calculated for the Venusian atmosphere and compared with the Mariner-5 S-band experiment. In the Earth's atmosphere the magnitude of the refractive-index fluctuations is usually not sufficient to cause serious fading of radio signals on line-of-sight paths. However, the Venusian atmosphere supports considerably stronger fluctuations because its density is much greater than Earth's. Depending on the frequency and depth of penetration of the radio signal into the Venusian atmosphere, fading up to 20 dB may be expected. A comparison of estimates with measured fading on the Mariner-5 S-band occultation experiment indicates reasonably good correlation. A detailed discussion of this key result is also presented. Author

N70-28760*# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
VENUS RADAR SYSTEMS INVESTIGATIONS Final Report
J. F. Reintjes and J. R. Sandison Mar. 1970 83 p refs
(Grant NGR-22-009-007)
(NASA-CR-110143; ESL-FR-418) Avail: CFSTI CSCL 17I

Initial efforts were on the design of scientific experiments for characterizing the roughnesses of planetary surfaces as determined by means of an instrument located in a spacecraft. Special attention was given to surface measurements of Planet Venus. Included in these studies were considerations of spacecraft trajectories, expected miss distances, and techniques for gathering data. A major objective of the project was to develop instrumentation which would be capable of making the required measurements and which would meet the rigid requirements of the space environment. A radar-type instrument that measures electromagnetic backscatter was designed and constructed; the instrument was tested while installed in a fixed-wing aircraft. The radar may be characterized as being lightweight and having low-power consumption; it is all solid-state with the exception of its low-power filament klystron transmitter. In the test program the instrument was flown in a NASA CV-990 aircraft and data on the X-band backscattering properties of various earth surfaces was determined. The results of experiments showed that gross surface features can be deduced by measurements of this kind. Author

N70-28814# Joint Publications Research Service, Washington, D.C.
ANTENNA SYSTEM FOR TROPOSPHERIC RADIO-RELAY COMMUNICATION LINES IN THE CENTIMETER WAVEBAND
B. S. Nadenenko 24 Apr. 1970 14 p refs Transl. into ENGLISH from Elektrosvyaz (USSR), Oct. 1969 p 15-23
(JPRS-50390) Avail: CFSTI

Design characteristics of the reflector in mirror-type parabolic antennas used in the centimeter waveband are discussed. Formulas are derived for calculating the electrical parameters of various antenna configurations. R.S.

N70-28889# Helsinki Univ. (Finland). Radio Lab.
RADIO LABORATORY Annual Report, 1 Aug. 1968 - 31 Jul. 1969
M. Tiuri 1969 12 p refs
(S-31-1969) Avail: CFSTI

Activities of the Radio Laboratory and its receiving station during the academic year are reviewed, including work on parametric, transistor and low-noise amplifiers, microwave filters, parabolic antennas etc. Author (ESRO)

N70-28904# Royal Radar Establishment, Malvern (England).
AN EXPERIMENTAL TWIN-PULSE MTI S-BAND RADAR WITH PULSE COMPRESSION
R. S. Peters Jul. 1969 40 p refs
(RRE-TN-743) Copyright. Avail: CFSTI

The report describes an experimental twin-pulse MTI (Moving Target Indicator) S-band radar capable of operating with or without pulse compression facilities. The major effect investigated was the contamination problem which exists when the pulse spacing is less than the extent of the clutter. Without pulse compression the effect is serious and pulse compression is shown to improve matters, enabling tracking of aircraft to take place through considerably extended clutter regions. Author (ESRO)

N70-28963# Groupe de Recherches Ionospheriques, Paris (France).
OBSERVATION OF DIRECTIONS OF PROPAGATION OF VERY LOW FREQUENCY WAVES AFTER TRAVEL THROUGH THE MAGNETOSPHERE [OBSERVATION DES DIRECTIONS DE PROPAGATION D'ONDES TBF APRES UN TRAJET MAGNETOSPHERIQUE]
J. C. Cerisier May 1970 15 p refs In FRENCH; ENGLISH summary Presented at the 13th COSPAR Meeting, Leningrad, 20-29 May 1970
(GRI-NTP-67) Avail: CFSTI

VLF waves, radiated by a ground transmitter and received in the Southern Hemisphere by the FR-1 satellite show the following characteristics: (a) Usually, the waves are not locally plane. However, locally plane waves have been observed at low latitudes. At mid-latitudes, the wave is made up of a spectrum of wave vectors, which are more or less widely spread; (b) Non-guided waves whose wave vectors are close to the resonance cone are often observed and these waves have a phase refractive index as large as 100 or more; (c) At a given time and place, it is common to observe two waves with different wave vectors and these waves also have different group delays between the transmitter and the satellite. Author (ESRO)

N70-29046# Joint Publications Research Service, Washington, D.C.
DIRECTIONAL ANTENNA FOR RECEPTION OF 360 MHz SATELLITE SIGNALS
Janusz Bator *In its* Transl. on Eastern Europe Sci. Affairs, No. 106 25 Mar. 1970 p 12-17 refs Transl. into ENGLISH from Prace Inst. Tele- i Radiotech. (Warsaw), no. 2, 1969 p 56-61
(See N70-29045 14-34) Avail: CFSTI

An antenna is described which is to be used with receiving equipment for measuring ionosphere properties by utilizing satellite-transmitted signals. The basic problems involved in antenna polarization are briefly discussed and the principal specifications of the antenna are described. Author

N70-29084# Deutsche Gesellschaft Fuer Ortung und Navigation E. V., Duesseldorf (West Germany).
SOME RESULTS OF GEODETICAL ELECTRONIC DISTANCE MEASUREMENTS IN THE NORTH SEA WET DUCT
R. Spellauge 1969 26 p refs Presented at the Intern. Navigation Meeting, Hamburg, 28-30 Oct. 1969
Avail: CFSTI

Tests of electromagnetic distance measuring equipment in the North Sea supported other reports of radio-operated measurements beyond the line-of-sight. Tropospheric refraction models having a maritime waveguide formed by the wet duct were successfully used to reduce the anomalous data. Computation of the trajectory and derivation of an integral-refractive index for the wave trajectory are also discussed. Author (ESRO)

N70-29107# National Lucht-en Ruimtevaartlaboratorium, Amsterdam (Netherlands).
ON THE REFLECTION PROPERTIES OF A PERIODICALLY SUPPORTED METALLIC WIRE GRATING WITH RECTANGULAR MESH SHOWING SMALL SAG DUE TO ITS OWN WEIGHT
G. J. v. d. Broek and J. v. d. Vooren 20 Feb. 1969 44 p refs
(NLR-TN-W-34) Avail: CFSTI

The ideal reflector simulation of a periodically supported metallic wire grating with rectangular mesh is considered. An approximative solution for the non-sagging grating of infinite extent under the action of a linearly polarized plane wave yields unique conclusions concerning the influence of the wire orientation, the mesh dimensions, and the connection between the wires at the mesh points. Consideration is also given to the sag of the grating due to its own weight. An order of magnitude estimation concerning the influence of this sag on the strength and phase shift of the reflection is derived from a simple scatter problem using Kirchhoff's approximation. This leads to a smoothness criterion that can be used to keep the influence of the sag within limits. Author (ESRO)

N70-29202# Hawaii Univ., Honolulu. Information Sciences Program.
SYNTACTICAL DECODERS AND BACKTRACKING S-GRAMMARS Interim Scientific Report
Celso de Renna e Sousa and Robert A. Scholtz Nov. 1969 37 p refs
(Contract F44620-69-C-0030; Grants AF-AFOSR-1251-67; DA-ARO(D)-31-124-G1045; Proj. Themis)
(AD-701796; AFOSR-70-0515TR) Avail: CFSTI CSCL 9/4

It is proposed that syntactical information be used to aid in the post-information-theoretic decoding of formal languages that have been transmitted through a noisy channel. A model for an information source producing a continuous stream of grammatical sentences is exhibited. General desirable properties of syntactical decoders are proposed, and a general minimum-distance decoding algorithm established. Backtracking S-grammars are defined, and used to exemplify backtracking algorithms for attempted correction of single and multiple errors. Author (TAB)

08 COMPUTERS

Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics.

N70-27808# Naval Research Lab., Washington, D.C. Electronics Warfare Div.
A FAST, FLEXIBLE, HIGHLY PARALLEL ASSOCIATIVE PROCESSOR Interim Report
John E. Shore and Frank A. Polkinghorn, Jr. 28 Nov. 1969 50 p
(AD-702394; NRL-6961) Avail: CFSTI CSCL 9/2

The logical design and operation of a general purpose associative processor (GPAP) is described. The basic circuit consists of a powerful associative cell which may be combined with an integral number of identical cells and implemented in MSI or LSI at a reasonable cost. A complete description of this cell, together with logic diagrams, Boolean equations, and a detailed timing analysis are presented. The processor obtained by connecting these cells together in quantity has both variable syllable and variable instruction capability. That is, the total associative word length can be split on a software basis into any number of syllables (fields), each of arbitrary length. The search criteria (greater than, less than, greater than or equal to, less than or equal to, exact match, and dont care) can be specified independently for each of these syllables. The search time depends only on the width of the largest syllable and is typically less than 1 microsecond (assuming gate delays of approximately 20 nanoseconds). The problem of multiple responses (priority resolution) is considered in detail. The design of a high-speed, inexpensive (in terms of the number of gates required per word) response rpsolution network is presented. Other GPAP operations include conventionally addressed read, write, add, multiwrite, multiadd, and logical operations. Simultaneous operations, such as write-on-match and add-on-match, are also possible. These capabilities, as well as several other unique properties of the design which contribute to its general purpose character and high speed of operation are described in detail. Author (TAB)

N70-27873# Stanford Research Inst., Menlo Park, Calif.
HIGH INFORMATION DENSITY STORAGE SURFACES Quarterly Report, 1 Jul. - 30 Sep. 1969
Louis N. Heynick Jan. 1970 41 p
(Contract DA-28-043-AMC-01261(E))
(AD-700975; ECOM-01261-18; QR-18) Avail: CFSTI CSCL 9/2

The program is devoted to the preparation and investigation of novel electron-beam addressable storage mosaics and to the construction of an experimental, large-capacity high-speed data-storage system utilizing such mosaics. The storage mosaics currently under development have elements consisting of discrete, submicron-size capacitors, called micro-caps, at the bases of regular arrays of closely spaced holes in molybdenum alumina/molybdenum film sandwiches on sapphire substrates. A basic technique developed for storage-mosaic formation is the use of a fine-mesh screen as an array of electrostatic electron lenses for resist exposure. In this technique, all apertures of the screen simultaneously form highly demagnified images, on electron-sensitive resist, of a simple object pattern such as a small, electron-illuminated array of holes. The geometric and electron-optical parameters are chosen so as to yield the requisite storage-element packing density. The preparation and use of high-precision, 1000-mesh screens and the recent improvements of the electron-illumination system for the object pattern now permit the formation of regular arrays of images over almost a full square centimeter of area. Each image consists of a 10 x 10 array of 1/2-micron spots on 1-micron centers and the images are on 25.4-micron centers, corresponding to a capacity of approximately 10 to the 7th power bits/sq cm. Complete storage mosaics of micron-cap elements in Mo/AlO3/Mo film sandwiches are now being prepared. Author (TAB)

N70-27880# RAND Corp., Santa Monica, Calif.
AN ON-LINE SYMBOLIC MATHEMATICS SYSTEM USING HAND-PRINTED TWO-DIMENSIONAL NOTATION
F. W. Blackwell and R. H. Anderson Jan. 1970 26 p refs
(Contract F44620-67-C-0045)
(AD-701721; RM-6018-PR) Avail: CFSTI CSCL 9/2

A description of a system being developed for the on-line manipulation of symbolic mathematical expressions is given. The user hand-prints his formulas, and the mathematical rules to be followed, on a Rand Tablet in ordinary two-dimensional mathematical notation. The system recognizes the characters and interprets the whole expression from the spatial relationships, in accordance with a previously input syntax. The user at his console directs the

computer to apply various rules of transformation that he has input. He maintains as much control over the transformations and the displays as he desires. Because the parser is entirely syntax-directed, the user can solve a wide variety of problems and can introduce novel operators as long as he declares their properties. Syntaxes that handle matrix notation and arbitrary directed-line graphs have been written and tested on the parser. Author (TAB)

N70-27899# Illinois Univ., Urbana. Coordinated Science Lab.
DESIGN CONSIDERATIONS OF ON-LINE DOCUMENT RETRIEVAL SYSTEMS
J. T. Cordaro, Jr. and R. T. Chien Feb. 1970 37 p refs
(Contract DAAB07-67-C-0199; Grants NSF GK-2339; OE-0-1-7-071213-4557)
(AD-701972; R-456; UILU-ENG-70-201) Avail: CFSTI CSCL 5/2

Response time of on-line document retrieval systems are analyzed. Linear and inverted file organizations are considered and their response times are evaluated. Author (TAB)

N70-27929# Geoscience Ltd., Solana Beach, Calif.
THE DESIGN OF A LITERATURE FILE IN AIRCRAFT-RELATED ENVIRONMENTAL MEDICINE
George L. Hody Nov. 1969 37 p refs
(Contract DABC01-69-C-0247)
(AD-701014; USAARL-70-9) Avail: CFSTI CSCL 5/2

The U. S. Army Aeromedical Research Laboratory (USAARL) is often required to make specialized measurements and perform applied research in aircraft-related areas of environmental medicine. Rapid access to the periodical literature is essential for the completion of many of these projects. A growing file of reprints from the periodical literature is available at USAARL. A method for the orderly storage of the reprints in printed form and a separate scheme for rapid retrieval of abstracts was developed for the file. Both methods were based upon the natural organization of the data. Storage of papers within the file will be based on the major topic of each reprint while retrieval will be accomplished by the use of key words. The combined system is expandable and can be easily adapted to a variety of mechanical, electro-optical and computer storage and retrieval methods. Author (TAB)

N70-28029# Air Force Cambridge Research Labs., Bedford, Mass.
AN EXPERIMENTAL DISPLAY PROCESSOR FOR THE DX-1
Edward N. Chase Jan. 1970 40 p refs *Its* Instrumentation Papers No. 164
(AD-702082; AFCRL-70-0044) Avail: CFSTI CSCL 9/2

An experimental two-console, core-buffered CRT display unit has been developed to advance display console design and improve digital hardware line- and curve-generating techniques. Static or dynamic graphical information can be displayed by either a black and white or full-color display processor under the control of a list processor designed for interfacing to a time-shared main computer. Author (TAB)

N70-28058# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ANALYSIS AND SYNTHESIS OF AUTOMATIC CONTROL (SELECTED ARTICLES) [ANALIZ I SINTEZ AVTOMATICHESKOGO UPRAVLENIYA]
V. V. Matushevskii et al 18 Dec. 1969 36 p refs Transl. into ENGLISH from Akad. Nauk SSSR, Otd. Mekhan. i Protsessov Upr. (Moscow), 1968 17 p
(AD-702330; FTD-MT-24-260-69) Avail: CFSTI CSCL 9/4

A statistical analysis based on the probability calculations of correct functioning of a system is presented for comparison of maps. The pertinent correlation function is calculated with the aid of the Mayer-Eppler or Kovasznay-Arman optical autocorrelators. A recognition problem is also discussed reduced to sorting and scanning of objects or patterns of specific configuration while satisfying a combination of aggradation signs. J.A.M.

N70-28087*# Arizona Univ., Tucscon. Dept. of Electrical Engineering.
A MODERN HYBRID COMPUTER INTERFACE
Jeffrey Martin Wilkins (M.S. Thesis) 1970 67 p refs
(Grant NGL-03-002-024)
(NASA-CR-109894) Avail: CFSTI CSCL 09B

This paper discusses the hybrid linkage system which interfaces the LOCUST high speed iterative differential analyzer and the PDP-9 digital computer to form a hybrid computing system. The interface comprises four analog-to-digital converters and four multiplying digital to analog converters for data transfer between computers. A control register, read-in gates and patchable flags provide digital control functions in the linkage. PDP-9 loaded counters and PDP-9 timing signals also add flexibility to the interface. Patching instructions and input/output transfer instructions which control the interface are discussed. An amplitude distribution example utilizing the interface demonstrates a type of problem that may be handled with the linkage. Author

N70-28172# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SHORT CHARACTERISTIC OF BASIC UNITS, THEIR COMPOSITION, AND REQUIREMENTS SET FOR ELECTRONIC COMPUTERS
N. I. Fadeev 23 Sep. 1969 38 p Transl. into ENGLISH from the Russian
(AD-702127; FTD-MT-24-233-68) Avail: CFSTI CSCL 9/2

The book is intended for engineers and technicians concerned with the design and production of electronic computers. It may also be used by students specializing in the field of computing technique. The book is an engineering monograph on production technology of electronic computer assemblies. A series of electronic computers and their technical characteristics are listed; descriptions are given of basic assemblies and their requirements, technological processes of their production, their instrumentation and equipment, and methods of controlling and testing them. The appendix includes a table that translates the physical units adopted in the book into the international unit system. TAB

N70-28289*# Honeywell, Inc., St. Petersburg, Fla. Aerospace Div.
STUDY OF TECHNIQUES FOR THE REDUCTION OF CREEP IN PLATED WIRE MEMORIES Final Report, 28 Jun. 1967 - 28 Aug. 1968
W. A. England and M. E. Petersen 28 Aug. 1968 41 p refs
(Contract NAS8-21151)
(NASA-CR-102648; HONEYWELL-21151-FR) Avail: CFSTI CSCL 09B

An overview of research conducted in a program for the modification of the geometry of 5 mil diameter plated wire to reduce creep and drive requirements is presented. Various approaches to minimize creep, the changes in magnetization produced by fields associated with currents along adjacent word lines, were taken and the results obtained are tabulated and discussed. Since creep is associated with bit packing density, the more obvious approach appeared to be in the use of discrete bits. Their use instead of a continuous plated film would eliminate the possibility of domain wall movement from bit to bit and possibly permit higher packing densities. Tests of discrete bands revealed that while they will reduce creep, they also introduce disadvantages other than those involved in fabrication. The principle difficulty arises from the shape anisotropy which creates a demagnetization term that increases greatly as the bit length is shortened. D.L.G.

N70-28298# Naval Research Lab., Washington, D.C.
RADAR: PROBLEM NOTES

In its Rept. of NRL Progr. Mar. 1970 p 41–42 (See N70-28291 14-34)
Avail: CFSTI

A study was made of the use of capacitor analog memory units as storage elements in radar signal-processing systems. A matrix of such units would include a storage capacitor and independent write-in and readout circuitry, as well as strobing circuitry that would direct write-in and readout to the desired storage elements. A store made up of capacitor analog memory units is ideally suited to applications in moving-target-indicator systems because (a) being a static store with nondestructive readout, it can be used with those radars having staggered or jittered pulse repetition frequencies which require the storage of a large number of radar sweeps, and (b) since the readout program is completely independent of the write-in program, the capacitor analog memory store can be used with either conventional LC doppler filters or with matrix filters. An extensive study determined that the matrix filter is the best type of filter for general use with the capacitor analog memory signal processor capable of giving 50 db of correlation gain on a typical search radar. Author

N70-28310*# Notre Dame Univ., Ind. Dept. of Electrical Engineering.
A COMPARISON OF THE FANO AND JELINEK SEQUENTIAL DECODING ALGORITHMS
John M. Geist 31 Jan. 1970 38 p refs
(Grant NGL-15-004-026)
(NASA-CR-109879; EE-701) Avail: CFSTI CSCL 09B

The results of a comparison by simulation of the performance of the Fano sequential decoding algorithm and an alternative algorithm by Jelinek are reported. A description of the Jelinek algorithm and decoder program is given. Search properties of the two algorithms are compared. Results indicate that the unmodified Jelinek algorithm is of no practical value, however, it is of interest theoretically because of the insight it provides into the nature of sequential decoding and its conceptual simplicity. When modified to avoid exact node ordering, the Jelinek algorithm is practical, having approximately the same computational complexity as the usual Fano algorithm. Which of the two algorithms is faster depends on the noise level of the channel, the Jelinek decoder being better on noisier channels. Author

N70-28350# Daresbury Nuclear Physics Lab. (England)
THE USE OF DATA LINKS TO THE IBM 360 SYSTEM AT DNPL
J. R. Brooks, T. Daniels, P. Heyes, A. C. Peatfield, and B. Zacharov Mar. 1969 26 p Presented at the Intern. Conf. on Remote Data Process., Paris
(DNPL/P-5; CONF-690321-1) Avail: AEC Depository Libraries

Data links are used at DNPL for communications between small computers local to nuclear experiments and the central 360/65 system. They are also used to connect data terminals for man-machine interaction. A short review is given of the implementation and exploitation of typical links developed at DNPL and, in particular, the fast links to remote PDP8 computers. The operation of a satellite IBM 1800 used as a buffer-multiplexing terminal is also described. Experience of some man-machine interactions, facilitated by the use of data links, is briefly summarized. Author (NSA)

N70-28351# Akademiya Nauk URSR, Kiev.
PROBLEMS IN DESIGN AND USE OF ELECTRONIC CONTROL COMPUTERS
N. S. Kulakovskaya, ed. 1968 161 p refs In RUSSIAN
Avail: CFSTI

Results are presented on research in synthesis of digital control computers. Problems of designing control and operational devices, and devices for communicating with the installation are considered. Articles are included which are related to the use of digital control computers to control complex installations. For individual titles see N70-28352 through N70-28370.

N70-28352# Akademiya Nauk URSR, Kiev.
SELECTION OF A SEMIPERMANENT MEMORY FOR DIGITAL CONTROL COMPUTERS
B. N. Malinovskiy, S. V. Svechnikov, V. M. Kvasov, V. V. Petrov, and Yu. Ya. Ledyankin *In its* Probl. in Design and Use of Electron. Control Computers 1968 p 5–9 refs In RUSSIAN (See N70-28351 14-08)
Avail: CFSTI

The use of an array based on capacitance and inductance as coupling elements is suggested, but such a system prevents the multiple recording of information. The use of photoresistors eliminates this difficulty. The problems encountered in the manufacture of photoarrays for semipermanent memories are discussed. The advantages of using the effect of transverse photoconductivity are pointed out. Transl. by H.W.

N70-28353# Akademiya Nauk URSR, Kiev.
A METHOD OF IMPLEMENTING DOUBLE-PRECISION OPERATIONS IN CONTROL COMPUTERS
Ye. V. Rutkovskiy and T. F. Slobodyanyuk *In its* Probl. in Design and Use of Electron. Control Computers 1968 p 10–18 refs In RUSSIAN (See N70-28351 14-08)
Avail: CFSTI

The required precision of information processing can be achieved in two ways: (1) in an arithmetic unit whose digital configuration corresponds to the required precision; or (2) in an arithmetic unit whose digital configuration is one-half the required precision; in this case, information-processing algorithms with double precision are used. The maximum execution rate for information processing with the required precision is achieved when using a circuit with a twenty-bit arithmetic unit. In the case when the larger part of the information must be processed with low precision, and the smaller part with double precision, it is expedient to construct the arithmetic unit according to the second method, and the information processing algorithm with double precision should be implemented in the local control block of the arithmetic unit. Transl. by H.W.

N70-28354# Akademiya Nauk URSR, Kiev.
INPUT DATA REQUIREMENTS FOR DESIGNING AUTOMATIC CONTROLS FOR DIGITAL CONTROL COMPUTERS
V. I. Kartashev *In its* Probl. in Design and Use of Electron. Control Computers 1968 p 19–34 refs In RUSSIAN (See N70-28351 14-08)
Avail: CFSTI

A method is suggested for simplifying the internal language of digital control computers. In the modular design stage, when the selection of registers is accomplished, an intercommunication is set up between them, and microprograms are compiled and converted, it is expedient to break such a complex system as the digital control computer into a number of interacting parts: (1) external devices, input and output plus external memory units; (2) the operational unit containing the arithmetic and control units; (3) the automated microprogram, in which the control of information conversion is conducted; and (4) the auxiliary unit containing the power source and synchronization. The key to this sytem lies in the separation of functions of the different units plus their mutual interaction. Recommendations are made for writing the program for the automated microprogram section. Transl. by H.W.

N70-28355# Akademiya Nauk URSR, Kiev.
DATA GATHERING SYSTEMS FOR DECENTRALIZED PRODUCTION FACILITIES

K. A. Netrebenko, V. B. Reutov, and S. V. Konstantinov *In its* Probl. in Design and Use of Electron. Control Computers 1968 p 35–42 refs In RUSSIAN (See N70-28351 14-08)
Avail: CFSTI

A process control system is described in which the electrical analog signals received from data sensors are coded using devices located in the immediate vicinity of the sensors. The information received can then be transmitted either in pulse-numeric, sequential binary, or binary-decimal code to the central data-gathering system located next to the digital computer. Such a system permits attaching the most diverse types of sensors to the coding devices and codes rather than analog signals are switched. The system can also operate from remote sensing stations. Transl. by H.W.

N70-28356# Akademiya Nauk URSR, Kiev.
AN ALGORITHM FOR CODING AUTOMATED MACHINES
S. P. Kartasheva *In its* Probl. in Design and Use of Electron. Control Computers 1968 p 43–57 refs In RUSSIAN (See N70-28351 14-08)
Avail: CFSTI

The criteria for single-address coding, the necessary and sufficient conditions for single-address coding of automated machines, an algorithm of single-address coding, and an algorithm for reducing uncoded automated machines to the coded type are studied. When synthesizing automated machines using threshhold elements, the problem arises of coding the determining function of excitation with separated variables. Monotone functions are a special case of functions with separated variables and coding which implements such functions is called single-address coding. Transl. by H.W.

N70-28357# Akademiya Nauk URSR, Kiev.
AUTOMATING THE DESIGN OF TYPICAL MODULES AND ASSEMBLIES OF DIGITAL DEVICES
V. N. Lopato *In its* Probl. in Design and Use of Electron Control Computers 1968 p 58–66 refs In RUSSIAN (See N70-28351 14-08)
Avail: CFSTI

An approach is proposed for solving the problem of increasing the probability of selecting the optimum solutions in the stages of modular synthesis and development of functional circuits for the separate modules. The general algorithmic structure of a binary n-bit counter is investigated, which can be represented in algorithmic language irrespective of the element structure. Transl. by H.W.

N70-28358# Akademiya Nauk URSR, Kiev.
INCREASING THE RELIABILITY OF MAGNETIC RECORDING DEVICES
R. Ya. Cehrnyak, V. M. Pavlik, and S. V. Melnik *In its* Probl. in Design and Use of Electron. Control Computers 1968 p 67–73 refs In RUSSIAN (See N70-28351 14-08)
Avail: CFSTI

A method of evaluating the characteristics of a magnetic digital recording system is investigated with respect to the criterion of reliability, and the approximate order of refining it during debugging is given for a method of zero-return recording. The optimum signal-to-noise ratio, which determines the operating reliability of the system, can be found by the given method. Transl. by H.W.

N70-28359# Akademiya Nauk URSR, Kiev.
SPACE FUNCTIONAL CIRCUITS IN A GIVEN SYSTEM OF MODULES
V. N. Lopato *In its* Probl. in Design and Use of Electron. Control Computers 1968 p 74–79 ref In RUSSIAN (See N70-28351 14-08)
Avail: CFSTI

A computer is used to automate conversion from functional to modular circuits. The necessity of using such programs to obtain initial data from a special data base on magnetic tape, which accumulates the information about the state of the design, rather than from working sketches, is pointed out. This method avoids many human errors which occur in large-scale programming of information. Transl. by H.W.

N70-28360# Akademiya Nauk URSR, Kiev.
COMBINING MICROPROGRAMMING AUTOMATONS WITH RESPECT TO THE PROPERTIES OF THE REAL ELEMENTS
V. I. Kartashev *In its* Probl. in Design and Use of Electron. Control Computers 1968 p 81–94 refs In RUSSIAN (See N70-28351 14-08)
Avail: CFSTI

The demands made on the algorithms used in combining a given set of microprograms are considered. Methods are investigated for finding and evaluating identical microoperational sequences for several microprograms in the initial design stage. Examples are given to show why it is not always feasible to construct all the possible intersections available in two or more automatons based on real elements. Transl. by R.B.

N70-28361# Akademiya Nauk URSR, Kiev.
CHARACTERISTIC FEATURES OF CONSTRUCTING ANALOG-TO-DIGITAL CONVERTERS WHEN USING REFERENCE ELEMENTS
L. A. Zhuk and A. M. Luchuk *In its* Probl. in Design and Use of Electron. Control Computers 1968 p 95–102 refs In RUSSIAN (See N70-28351 14-08)
Avail: CFSTI

Several methods are described for constructing of analog-to-digital converters for use in computer control systems in which accuracy and speed are of prime importance. Two methods are discussed for analog-to-digital conversion: the first is one in which pulses with a repetition frequency equal to the measured frequency are fed into the counter for a selected, fixed time interval. The second method is based on calculating the number of reference high frequency pulses during one or several periods of the measured frequency. Transl. by H.W.

N70-28362# Akademiya Nauk URSR, Kiev.
AMPLITUDE CONVERTERS FOR RESISTANCE THERMOMETERS AND DIFFERENTIAL TRANSFORMER PICKUPS
S. V. Konstantinov and K. A. Netrebenko *In its* Probl. in Design and Use of Electron. Control Computers 1968 p 103–109 refs In RUSSIAN (See N70-28351 14-08)
Avail: CFSTI

Unitized converters are considered for controlling computers which are constructed on the principle that compensating circuits of amplitude voltmeters with capacitive memory may be used as standardized converters for ac pickups. The different devices consist of a pulsed device for converting resistance to voltage, converters for variable mutual inductance pickups, and switching elements for the converters in the control machine. Transl. by R.B.

N70-28363# Akademiya Nauk URSR, Kiev.
SEMICONDUCTOR PHASE-TIME CONVERTER
V. G. Pahenichnyy *In its* Probl. in Design and Use of Electron. Control Computers 1968 p 110–115 refs In RUSSIAN (See N70-28351 14-08)
Avail: CFSTI

The problems connected with the construction of a [illegible] detection circuit are studied for a device which converts phase into time. In the case when increased precision is required for conversion, excellent results are obtained by using a combined circuit, in which both passive and active shaping circuits are introduced, for the

detection of the zero voltage. The precision of such a device is on the same order as that obtained when using amplifier limiters, but using much simpler technical methods. Transl. by H.W.

N70-28364# Akademiya Nauk URSR, Kiev.
PHOTOELECTRIC DEVICES FOR CONVERTING GRAPHICAL DATA TO DIGITAL CODE
V. M. Kvasov *In its* Probl. in Design and Use of Electron. Control Computers 1968 p 116-122 refs (See N70-28351 14-08)
Avail: CFSTI

Converters based on rows of cross sectional film photoresistors used as different types of photoreceivers are described. Only those photoelectric converters are considered which read graphs imaged on a dark background. Transl. by R.B.

N70-28365# Akademiya Nauk URSR, Kiev.
ANALOG DIGITAL CONVERTER WITH A VARIABLE DEVICE FOR CONVERTING SIGNALS TO CODE SIGNALS FROM dc PICKUPS WITH A UNITIZED OUTPUT OF 0 TO 5 ma (0 TO 5 VOLTS)
Ye. S. Oreshkin and O. L. Yermakov *In its* Probl. in Design and Use of Electron. Control Computers 1968 p 123-127 In RUSSIAN (See N70-28351 14-08)
Avail: CFSTI

The circuit diagram and operating principles for the converter are presented. Components of the unit such as the sawtooth generator, comparison circuit, and pulse shaper are described. The converter consists of a measuring and a reference channel. Transl. by H.W.

N70-28366# Akademiya Nauk URSR, Kiev.
ANALOG DIGITAL CONVERTER WITH A VARIABLE CONVERSION SCALE
T. F. Bekmuratov *In its* Probl. in Design and Use of Electron. Control Computers 1968 p 129-133 ref. In RUSSIAN (See N70-28351 14-08)
Avail: CFSTI

An analog to digital converter is studied whose conversion scale is varied by changing the steepness of the linearly varying compensating signal. The input voltage is converted into a time interval by comparing it to the linearly varying compensating signal. The interval obtained is filled with pulses of fixed frequency. A block-diagram of the converter is given and the push-pull nature of the operation is shown. Transl. by H.W.

N70-28367# Akademiya Nauk URSR, Kiev.
USING CONTROL COMPUTERS FOR DIAGNOSTIC CONTROL OF RADIO EQUIPMENT
V. S. Kalenchuk and I. A. Yanovich *In its* Probl. in Design and Use of Electron. Control Computers 1968 p 134-140 refs In RUSSIAN (See N70-28351 14-08)
Avail: CFSTI

A system is described for diagnostic control of radio equipment in which failures are classed as either sudden or as a result of gradual deterioration. The various circuits of the system are discussed in detail. Transl. by H.W.

N70-28368# Akademiya Nauk URSR, Kiev.
INTRODUCTION OF THE DNEPER CONTROL COMPUTER INTO A LARGE-SCALE AUTOMATION SYSTEM FOR BLAST FURNACE PROCESSES
R. M. Nikolaychuk, V. L. Dubinchuk, and A. N. Zhadko *In its* Probl. in Design and Use of Electron. Control Computers 1968 p 141-153 In RUSSIAN (See N70-28351 14-08)
Avail: CFSTI

The control computer is used to optimize the blast furnace process by calculating and transferring corrective control input to local circuits of automatic control and stabilization, using the control algorithm for blast furnace processes. The control algorithm employs certain solutions such as temperature measurement in the tuyere zone, intermittent control of dust removal from the waste gas, temperature measurement around the radius of the charge hole, remote monitoring of coke weight, and remote measurement of the amount of the air blast into the furnace. The control system is almost completely constructed of contactless frequency-ferrodynamic components and is distinguished by employment of an intermediate link between the blast furnace and the computer. A rational network with a mimic flowchart and common control panel, on which all automation and control systems are concentrated, is included. Transl. by R.B.

N70-28369# Akademiya Nauk URSR, Kiev.
EXPANDING THE OPERATIONAL POSSIBILITIES AND QUALITIES OF THE DNEPER CONTROL COMPUTER USED IN ELECTROPLATING
A. N. Strutinskiy, Zh. D. Zhdanov, and K. V. Golovko *In its* Probl. in Design and Use of Electron. Control Computers 1968 p 154-159 refs In RUSSIAN (See N70-28351 14-08)
Avail: CFSTI

Mathematical modelling of the electroplating process plus the solution of problems, such as transporting parts and controlling the production process, required an increase of the read-only memory, the expansion of information retrieval from the machine, and the solution of communications problems. To increase the operational properties of the computer, the circuits of the single pulse generator and the printing unit were modified. In the single pulse generator the electromechanical circuit is replaced by an electronic one, and in the printing unit a matrix circuit is used for selecting the electromagnets. Circuit diagrams are given and the operation of each modified unit is described. Transl. by H.W.

N70-28370# Akademiya Nauk URSR, Kiev.
AN ADAPTIVE NETWORK OF DATA GATHERING AND PROCESSING FOR THE DNEPER GENERAL-PURPOSE CONTROL COMPUTER USED TO CONTROL OPEN-HEARTH PROCESSES
Ye. I. Gubenko *In its* Probl. in Design and Use of Electron. Control Computers 1968 p 160-167 refs In RUSSIAN (See N70-28351 14-08)
Avail: CFSTI

Process algorithms are discussed for automation of open-hearth furnaces using the Dneper computer. The random processes taking place in the furnace are described by formulas derived by converting monotone random functions to stationary random functions, and the algorithms for the different processes are described. Transl. by R.B.

N70-28455# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ACADEMY OF SCIENCES OF THE UKRAINIAN SSR. PROBLEMS IN THE DESIGN AND UTILIZATION OF ELECTRONIC COMPUTERS (SELECTED ARTICLES)
V. N. Lopato et al 29 Dec. 1969 51 p refs Transl. into ENGLISH from the book "Voprosy Proektirovaniya i Ispolzovaniya Elektronnykh Upravlyayushchikh Mashin" Kiev, Naukova Dumka, 1968 33 p
(AD-702298; FTD-MT-24-261-69) Avail: CFSTI CSCL 9/2

Contents: Distribution of functional circuits in a specified system of modules; Merging of microprogram automata with allowance for properties of real elements; Photoelectric converters of graphical information into digital code; and System for sampling and processing of information with UMShN Dnieper for control of the open-hearth process. TAB

N70-28456# RAND Corp., Santa Monica, Calif.
SOVIET CYBERNETICS REVIEW, VOLUME 4, NO. 1
Wade B. Holland Jan. 1970 69 p refs
(Contract F44620-67-C-0045; Proj. RAND)
(AD-701720; RM-6200/1-PR) Avail: CFSTI CSCL 9/2

The January issue features a major historical survey of Soviet computer technology, including photographs of nearly all Soviet computers in operation today. The article covers Soviet computer development, beginning with an analog device in 1941 and continuing through current efforts to incorporate integrated circuit technology, including the Ryad project which is aimed at eventual production of System/360-compatible hardware. The Mir-2 computer with graphic terminal light pen is discussed. Overheating in vacuum tube computers, a nagging problem for the Soviets, is explored. Other articles probe computerized crime detection, automated machine system development, computerized national economic planning, automation in the State Bank, and use of computers in planning Western Basin fishing fleet operations. Author (TAB)

N70-28555# California Univ., Livermore. Lawrence Radiation Lab.
TIME-SHARE VERSUS DEDICATED SYSTEMS AND HARDWARE-SOFTWARE TRADEOFFS
Roger E. Anderson 17 Dec. 1969 39 p Presented at the Stored Program Controller Symp., Albuquerque, N. Mex., 23 - 24 Sep. 1969
(UCRL-72093; Conf-690938-1) Avail: CFSTI

Software and hardware systems are evaluated for their use in laboratory automation. The time share systems using a PDP-7 computer are assessed having ordinary instruments interfaced into the system, including a mass spectrometer and CHN analyzer. Dedicated systems are being developed using the PDP-8/S computer with a complement of 10 peripherals. Time share and dedicated systems are also compared for the best approach to laboratory automation. Search and operator type languages are evaluated emphasizing on-line programming. J.A.M.

N70-28584*# Martin Marietta Corp., Denver, Colo.
A STUDY PROGRAM ON THE DEVELOPMENT OF A MATHEMATICAL MODEL(S) FOR MICROBIAL BURDEN PREDICTION. VOLUME 8: REVISIONS TO VOLUME 6, USER'S MANUAL Final Report, Addendum
Lloyd B. Farabee Apr. 1970 46 p Prepared for JPL
(Contracts NAS7-100; JPL-952532)
(NASA-CR-110141; MCR-68-97-Vol-8) Avail: CFSTI CSCL 09B

The Input Translator Program (ITP) has been developed. The ITP performs much of the repetitious and time-consuming work involved in preparing input data. In addition, it also performs bookkeeping chores such as maintaining the current status of all parts. The ITP has been programmed so that only minor revisions have been made to the previously developed portions of the program. In most cases, an error of input data to the ITP is printed as an error, but does not stop the production of an input tape for the Tape Alteration Subroutine (TAS). The manual preparation of input data is therefore reduced to coding the JPL Quality Assurance Daily Activity Report information for key punching, key punching this information, and making corrections to the errors which are flagged by the ITP. Author

N70-28599# Union Carbide Corp., Oak Ridge, Tenn. Computing Technology Center.
A STUDY OF CONTROL SYSTEM SENSITIVITY
James Bradley Mankin, Jr. Dec. 1969 241 p refs
(Contract W-7405-eng-26)
(CTC-21) Avail: CFSTI

A study of sensitivity from a unified viewpoint results in the development of a general formulation of the sensitivity problem. Several examples are presented to illustrate the effectiveness of this formulation of sensitivity. Among these examples is the development of an algorithm which combines the computation of the state trajectory with the computation of the trajectory perturbation or the trajectory sensitivity functions. The control perturbation or control sensitivity function is included as an integral part of the algorithm. Efficient numerical methods and digital computer programs are developed to utilize these algorithms effectively. Bounds are developed for the round-off and truncation errors incurred in the computation of transition matrices. Using these bounds, an algorithm is developed for the efficient computation of transition matrices which reduces errors in the selection of computation parameters. Using the algorithm for the computation of trajectory sensitivity functions, an algorithm is developed for the synthesis of low sensitivity optimal controls. Author

N70-28629# Maryland Univ., College Park. Computer Science Center.
EDGE AND CURVE ENHANCEMENT IN DIGITAL PICTURES
Azriel Rosenfeld, Richard B. Thomas, and Yung H. Lee May 1969 135 p refs
(Contract AT(40-1)-3662)
(ORO-3662-4; TR-69-93) Avail: CFSTI

Simple nonlinear local picture processing operations are described which emphasize edges and curves in a picture while suppressing noise. The generalization of these operations to permit the detection of a broad class of differences in visual texture between adjacent regions in a picture is discussed. Author

N70-28657*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE DATA REDUCTION LABORATORY REFERENCE MANUAL
B. A. Walton, J. J. Quann, and F. A. Keipert Jan. 1969 113 p
(NASA-TM-X-63524; X-565-69-56) Avail: CFSTI CSCL 09B

The laboratory, its capability for rapid on-line program generation and data manipulation, and the directions for its use are described. Details are given on the process of initialization, dialog, syntax, execution, and printer output. An example using OGO spacecraft data and the subset of capabilities anticipated for support of the OGO-F launch are also presented. N.E.N.

N70-28717*# Maryland Univ., College Park. Computer Science Center.
ON THE NUMBER OF TREES WITH n TERMINAL NODES
Jack Minker and Daniel H. Fishman Apr. 1970 55 p refs
(Grant NGL-21-002-008; Contract NBS CST-821-5-69)
(NASA-CR-110178; TR-70-112) Avail: CFSTI CSCL 09B

Three types of trees are considered: trees with at least two branches from all but terminal nodes, trees with at least two but no more than m branches from all but terminal nodes, and trees with exactly m branches from all but terminal nodes. The last type of tree in this list, which is called a complete m-ary tree, receives the major emphasis. Two approaches are pursued in the development of explicit formulae which give the number of complete m-ary trees with n terminal nodes, for arbitrary m and n. The first approach is along the more conventional line of generating functions. The generating function for m-ary trees with n terminal nodes is obtained. In the second approach, a tree grammar is introduced which generates the complete m-ary trees as linear strings of 1's and 0's. Using the notion of a syntax recognizer, theorems are proved which give the number of strings of length n + k for arbitrary n and k which have at least k terminal nodes. This is done for binary trees, and then for the general case of m-ary trees. Author

N70-28718*# General Instrument Corp., Salt Lake City, Utah. Microelectronic Div.
DIGITAL DATA SAMPLING MODULES, PART 1 Final Report

Apr. 1970 126 p ref
(Contract NAS8-30003)
(NASA-CR-102704) Avail: CFSTI CSCL 09B

The digital data sampling system with a random access, distributed data gathering system is described. The system will accept data from up to 128 data modules, with each data module handling 8 channels of data for a total of 1024 remotely located data sources. The various data modules are connected along a common command-response-power cable at random intervals in party line fashion and may be addressed by a unique command data address word. Upon receipt of the proper command address word, a particular channel within a particular module will accept analog data from that data source, convert the data to digital form, transmit the response word back to a central location and present it in proper form to a central data processor (computer). The unique features of this system are: (1) the large degree of circuit and subsystem integration, (2) the small physical size of the remote data sampling modules, (3) the low power requirements of the data modules which is achieved by special low power circuit design and a power switching scheme, and (4) the minimum number of interconnecting cables used to collect the large number of data signals. Author

N70-28719*# General Instrument Corp., Salt Lake City, Utah. Microelectronic Div.

DIGITAL DATA SAMPLING MODULES. PART 2: SYSTEM CONTROLLER Final Report

Apr. 1970 50 p
(Contract NAS8-30003)
(NASA-CR-102705) Avail: CFSTI CSCL 09B

The System Controller (S.C.) which receives command data words from the computer and generates a differential trilevel command signal to the modules is described. The addressed module responds with a differential trilevel response word which the S.C. converts to a parallel data word for the computer. The computer can be programmed to generate command words as desired depending on the data collection required, and to analyze the response data and output test results. The test program is used to test the modules and verify that the system is working correctly. The System Controller can also operate off line (independent of the computer). The command word bits are selected by the front panel controls and the response word is displayed on the panel. Author

N70-28787*# Maryland Univ., College Park. Dept. of Physics and Astronomy.

A DESCRIPTION OF THE CONTROL PROGRAM FOR THE LUNAR RANGING EXPERIMENT

J. D. Rayner Nov. 1969 66 p Submitted for publication
(Grant NGR-21-002-109)
(NASA-CR-110210; TR-70-064) Avail: CFSTI CSCL 09B

The lunar ranging ground station built around a Varian 620/i control computer is discussed. This arrangement gave operating flexibility, as well as providing computational capability. Three main computer functions were required: (1) to control the firing of the laser and gate the return pulse, to calculate an approximate range from the data, and to record the raw data supplemented by calibration data on magnetic tape. The computer laser controls using two external control lines, one to fire the flash lamps and one to enable the Pockels cell are evaluated. Author

N70-28794*# Maryland Univ., College Park. Dept. of Physics and Astronomy.

A DESCRIPTION OF THE TIME INTERVAL MEASUREMENT AND LASER CONTROL CIRCUITRY FOR THE LUNAR RANGING EXPERIMENT

C. A. Steggerda Nov. 1969 82 p refs
(Grant NGR-21-002-109)
(NASA-CR-110140; TR-70-049) Avail: CFSTI CSCL 09B

The laser control and time interval measurement circuits were combined with a detector package, a laser, and an astronomical telescope. This system is designed to measure the time of flight of a light pulse to a lunar retroreflector and back to an accuracy of 1 nanosecond with a precision of 100 picoseconds. The range is computed by adding an analog measurement of the time between the outgoing laser pulse and an initial frequency standard clock pulse. To prevent the system from measuring random photons, a window pulse is provided to activate the final time to pulse height converters. The lunar ephemeris, recorded on magnetic tape and read by a Varian data machines 620/i computer, is used to generate this window pulse. Author

N70-28805# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.

UTILITY PROGRAMS FOR GAMBIT THERMAL RANGE LIBRARY

G. Collier and L. L. Moran Oct. 1969 80 p refs
(WANL-TME-1970) Avail: CFSTI

The three utility programs which create and verify thermal range libraries for the GAMBIT program are described. UPDATE creates the thermal range library. MODPLOT performs a check on moderator kernels and produces a plot of the results. GAB creates a gas library for the linkage in the GAMBIT program. Author (NSA)

N70-28821*# Pittsburgh Univ., Pa. Space Research Coordination Center.

LEARNING ALGORITHMS FOR MULTI-CLASS PATTERN CLASSIFICATION AND PROBLEMS ASSOCIATED WITH ON-LINE HANDWRITTEN CHARACTER RECOGNITION

T. L. Teng and C. C. Li 13 Feb. 1970 188 p refs
(Grant NGL-39-011-002)
(NASA-CR-110203; SRCC-119) Avail: CFSTI CSCL 09B

Two contributions are made in this dissertation: (1) a study of an on-line handwritten alphanumeric character recognition system, and (2) the proposition of a new learning algorithm for multi-class linear pattern classification. In the study of an on-line handwritten character recognition system, each character was written in a standard stroke sequence. The character was encoded by the modified, quantized direction-time features where, in addition to the directions of the stroke segments, three kinds of additional feature components were incorporated: jumping component, reference component, and end component, to enhance the pattern separability and the feasibility of reconstruction. The proposed multi-class learning algorithm was based upon the mapping of pattern vectors of R classes into the neighborhood of R vertices of a (R-1)-dimensional equilateral simplex with its centroid at the origin. Author

N70-28832# Battelle-Northwest, Richland, Wash. Reactor and Plant Technology Dept.

A USER'S PLANT MANUAL FOR 2DB6: A DIFFUSION THEORY SHIELDING CODE

D. R. Marr Feb. 1970 41 p refs
(Contract AT(45-1)-1830)
(BNWL-1291) Avail: CFSTI

Revisions were made in the two-dimensional, multigroup neutron diffusion code 2DB to facilitate its use in shielding calculations. The revised code, 2DB6, employs the same basic mathematical model. Changes were made to increase the rate of convergence and to improve monitoring and control of the convergence process, particularly for points far from the source; and to incorporate additional versatility in input and output, including linkages to a flux plotting routine. Author (NSA)

N70-28840# Sandia Corp., Albuquerque, N. Mex.

CONVIP: A PROGRAM LINKING SWAP-9 TO WONDY-3

C. D. Lundergan Dec. 1969 45 p refs
(SC-DR-69-840) Avail: CFSTI

The computer program, CONVIP, transfers a problem which has been run by the WONDY-3 program up to a predetermined

time into the SWAP-9 program for completion of the problem. For a certain class of one-dimensional rectilinear wave propagation problems this procedure substantially reduced the computer time required to obtain a solution. The class of problems consists of those in which large regions of the medium are in uniform motion, have time-dependent energy deposition or boundary conditions, require many meshes for an adequate description in the WONDY-3 program, and require several microseconds for solution. Author (NSA)

N70-28847*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
USER'S MANUAL, CONTROL SYSTEM OPTIMIZATION HYBRID COMPUTER PROGRAM Final Report
C. L. Connor Feb. 1970 61 p refs
(Contract NAS8-30515)
(NASA-CR-102620; HREC-0515-3; LMSC/HREC-D162122-3) Avail: CFSTI CSCL 09B

This report describes a computerized tool to be used in the design of optimal control systems. The design method is based on modern control theory, high-speed hybrid simulation and the use of powerful gradient techniques. The specific purpose of the method is to find for a given control law, time-varying controller adjustments which minimize a selected performance measure J. This performance measure J can be freely chosen to best reflect the design goals. Even minimax design criteria can be specified where certain peak values P of critical state variables must be minimized. If P represents the major term in the performance criterion J, then P will be minimized in the course of the optimization. The program is written for an EAI 8900 Hybrid computer. Author

N70-28879# Oak Ridge National Lab., Tenn.
XYPLOT: AN ELEMENTARY GRAPHICAL PREPARATION ROUTINE FOR THE CRT PLOTTERS
Melvin Tobias and Lincoln Jung 28 Jan. 1970 20 p
(Contract W-7405-eng-26)
(ORNL-TM-2867) Avail: CFSTI

The purpose of the routine described here is to make available to those with little or no knowledge of programming some of the features of the extensive CRT graphics work which has been done by both the Mathematics Division and the Computing Technology Center. The present program enables the user to prepare a linear, semi-logarithmic, or logarithmic plot displaying either continuous curves, or individual points or both. The graph is produced on a piece of 35 mm film which may be used to make prints or slides. Within the limitations of the plotting equipment, the standards and practices for drawing employed in the Reactor Division have been followed. Author

N70-28880# Sandia Corp., Albuquerque, N. Mex. Advanced Techniques Div.
PROGRAM DOCUMENTATION FOR ACCEL MOD 2
Clifford J. Fisk and David L. Caskey Dec. 1969 264 p refs Sponsored by AEC
(SC-M-69-602) Avail: CFSTI

A manual which provides sufficient information for a programmer to understand the operation of the ACCEL system is presented. It explains the functions and parameters of the various links and subroutines, and data formats used in the system. The Mod 2 ACCEL is written entirely in FORTRAN. Author

N70-28892# Iowa State Univ. of Science and Technology, Ames. Ames Lab.
INTERPRETIVE LANGUAGE WITH AN ASSOCIATED DATA STRUCTURE
Fred John Zamecnik, Jr. (Ph.D. Thesis) Jan. 1970 99 p refs
(Contract W-7405-eng-82)
(IS-2243) Avail: CFSTI

The theory and implementation of a programming language called AMP which is a simulation of an associative memory structure is described. The language consists of a structured memory base imbedded in an interpretive language processor which has powerful recursive properties. The affected areas, the language structure, the storage technique, the program implementation, and the possible extensions are described. This particular implementation was written for an IBM 360/65. Author (NSA)

N70-28921# Sandia Corp., Albuquerque, N. Mex.
DEVELOPMENTS IN TECHNIQUES FOR COMPUTATION OF BESSEL FUNCTIONS BY DIGITAL COMPUTERS
R. D. Halbgewachs Feb. 1970 44 p refs Sponsored by AEC
(SC-M-70-3) Avail: CFSTI

Techniques have been selected, developed, and implemented for computing Bessel functions with complex arguments and real orders, both varying simultaneously over extremely wide ranges of values. This paper describes these techniques and how they overcome such difficulties as exponential overflow or underflow, storage of very large arrays, and loss of accuracy during multiple sequences of recursion relations in Bessel function calculations. A new approach to validation testing is presented and the computer routines which use these techniques are discussed. Author

N70-28973# Gulf General Atomic, San Diego, Calif.
TAC2D: A GENERAL PURPOSE TWO-DIMENSIONAL HEAT TRANSFER COMPUTER CODE. MATHEMATICAL FORMULATIONS AND PROGRAMMER'S GUIDE
S. S. Clark and J. F. Petersen Sep. 1969 215 p refs
(Contract AT(04-3)-167)
(GA-9262) Avail: CFSTI

TAC2D is a code for calculating steady-state and transient temperatures in two-dimensional problems by the finite difference method. It is written entirely in Fortran V. The configuration of the body to be analyzed is described in the rectangular, cylindrical, or circular (polar) coordinate system by orthogonal lines of constant coordinate called grid lines. The grid lines specify an array of nodal elements. Nodal points are defined as lying midway between the bounding grid lines of these elements. A finite difference equation is formulated for each nodal point in terms of its capacitance, heat generation and heat flow paths to neighboring nodal points. A system of these equations is solved by an implicit method which is one of the most efficient known at this time. Author

N70-28975# Sandia Corp., Livermore, Calif. Numerical Applications Div.
ONEDIM: A COMPUTER CODE FOR SOLVING ONE-DIMENSIONAL NONLINEAR HEAT TRANSFER PROBLEMS
V. K. Gabrielson, B. W. Grange, and K. D. Christian Feb. 1970 92 p refs
(Contract AT(29-1)-789)
(SCL-DR-69-99) Avail: CFSTI

The computer code ONEDIM is used for solving transient and steady-state heat transfer problems of composite structures that can be modeled as slabs, cylinders, or spheres. Special features include variable material properties with phase changes plus radiation and convection options at the surface. Sources can be applied to any zone, and special options can be applied to internal gaps. Implicit integration with automatic time-step-control is used. Input is mnemonic, and flexible editing and plotting are available. Author (NSA)

N70-28985# California Univ., Berkeley. Lawrence Radiation Lab.
SOME EXPERIENCES WITH PULSE HEIGHT ANALYSIS USING A DISK
David W. Jenson Nov. 1969 9 p Presented at Fall Symp. of Digital Equipment Computer Users Soc., Las Vegas, Nev.
(Contract W-7405-eng-48)
(UCRL-19402; CONF-691110-2) Avail: CFSTI

A partial description of two systems for pulse-height analysis that store histograms on a movable-head disk is given, with emphasis on techniques for continuously updating histograms stored on a disk and for controlling data flow through asynchronous parallel processes of differing priorities. One of the systems is capable of updating 16,384 channels of histogram on the disk at a continuous rate of 750 events per second using a PDP-5. Some projected data-handling rates for a PDP-8 and a head-per-track disk are given. Author (NSA)

N70-29004*# University of Southern Calif., Los Angeles. Electronic Sciences Lab.
TRANSFORM IMAGE CODING Final Report
William K. Pratt and Harry C. Andrews Mar. 1970 154 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952312)
(NASA-CR-110153; USCEE-387) Avail: CFSTI CSCL 09B

The basic goal of digital image coding is the development of a coding technique that permits the representation, and subsequent recovery, of an image by a minimal number of code bits. By the use of Fourier, Hadamard, and other mathematical transforms for image coding, a generalized technique of transform image coding has been developed. This method is discussed in detail. Author

N70-29077# Princeton-Pennsylvania Accelerator, Princeton, N.J.
OPERATING EXPERIENCE WITH A MODULAR DIGITAL DATA SYSTEM FOR HIGH ENERGY PHYSICS
T. Droege, J. Mc Fadden, S. Wash, and R. Von Colln 17 Nov. 1969 22 p refs Presented at the IEEE 1969 Nucl. Sci. Symp., San Francisco, 29-31 Oct. 1969
(Contract AT(30-1)-2137)
(PPAD-671-E; CONF-691017-7) Avail: CFSTI

From 16th Nuclear Science Symposium, San Francisco, Calif. A modular digital data system originally designed for matnetostrictive wire spark chambers has been expanded to include most digital high energy physics data. The system is built around a 12 bit data bus and has been implemented for a number of computers and other output devices. Author (NSA)

N70-29088# Colorado Univ., Denver. Medical Center.
RADIOISOTOPE INVENTORY PROGRAM
David S. Groome Dec. 1969 15 p Sponsored by AEC
(C001472-26) Avail: CFSTI

Nuclear medicine is unique in that the pharmaceuticals stocked in the laboratory's inventory are constantly being depleted by radioisotope decay whether any of the material is used or not. This presents an unusual problem in inventory control, and one particularly suited for the use of a digital computer. A set of programs was developed for a process control computer which completely control a radioisotope inventory. The computer operates in the multiprogramming mode, allowing several programs to be excuted oncurrently. This system of radioisotope inventory control alleviates the need of the technican making and recording repetitive decay calculations and ensures that the calculations will be error free. Additionally, records of each calculation and the isotope usage are maintained in printed form. Author (NSA)

N70-29100*# Martin Marietta Corp., Denver, Colo.
A STUDY PROGRAM ON THE DEVELOPMENT OF MATHEMATICAL MODEL(S) FOR MICROBIAL BURDEN PREDICTION. VOLUME 9: REPORT ON THE MARINER MARS 69-3 BURDEN PREDICTION Final Report Addendum
Lloyd B. Farabee Apr. 1970 160 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952532)
(NASA-CR-110145) Avail: CFSTI CSCL 09B

A number of changes were identified that would improve the effectiveness of the computer program and the input translater program was developed as a more manageable data input method for the MBPM. It is recommended that the input data to the MBPM and the swab sampling be reviewed to gain insight into the reason for the differences in prediction, and into the reasons for the divergence in slope of the curves. F.O.S.

N70-29108*# Martin Marietta Corp., Denver, Colo.
A STUDY PROGRAM ON THE DEVELOPMENT OF MATHEMATICAL MODEL(S) FOR MICROBIAL BURDEN PREDICTION. VOLUME 7: USER'S MANUAL FOR THE INPUT TRANSLATOR PROGRAM Final Report Addendum
Lloyd B. Farabee Apr. 1970 65 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952532)
(NASA-CR-110144) Avail: CFSTI CSCL 09B

The input translator program (ITP) for the MBPM is presented in a user's manual which describes the various subroutines, the method of data input, and the process of transferring the output data. It is concluded that the program performs satisfactorily on the CDC 6400/6500 and on the Univac 1108. On the 1108 the run must be subdivided into sections by exercising the restart option of the ITP. F.O.S.

N70-29118# Chicago Univ., Ill. Inst. for Computer Research.
ICR QUARTERLY REPORT NO. 22
Victor H. Yngve 1 Aug. 1969 99 p refs
(Contract AT(11-1)-614)
(COO-614-71; QR-22) Avail: CFSTI

The program simulation facilities which have been implemented on Maniac 3 to allow software to be coded and debugged for the yet to be completed multicomputer system are described. A detailed specification of the simulator assembly language accepted by Assembler 3.5 is presented. Also, three papers are included on unnormalized floating-point arithmetic as approximate interval arithmetic, pulsing supernova, and exact probabilities of a voter's paradox through seven issues and seven judges. NSA

N70-29125# Illinois Univ., Urbana. Dept. of Computer Science.
ILLIAC 3 COMPUTER SYSTEM MANUAL: ARITHMETIC UNITS, VOLUME 1
Daniel E. Atkins Dec. 1969 242 p refs
(Contract AT(11-1)-1018)
(COO-1018-1194; Rept-366) Avail: CFSTI

The arithmetic data formats, arithmetic instructions, and internal static descriptions are given. The block diagram of an arithmetic unit and the verbal function, block diagram, and actual logic of each subsystem are given. Each order executed in an arithmetic unit is described as a sequence of suboperations, which are defined verbally and with flow charts and tables. A list of signal names together with PL/1 definition is included. N.E.N.

N70-29142# Illinois Univ., Urbana. Dept. of Computer Science.
GRAPH TRANSFORMATIONS FOR COMPOSITE FORMATION
John C. Schwebel 12 Dec. 1969 26 p refs
(Contract AT(11-1)-1018)
(COO-1018-1195; Rept-368) Avail: CFSTI

Transformations of labelled directed graphs are defined and investigated. The properties of composite formation under a binary relation are shown to be sufficient conditions for some graph transformations. Implications between the defined transformations are also determined. A method of classifying relations involved in a transformation is demonstrated. A partial classification is performed on the basis of the defined transformations and on the abstract properties of the constituent relations. Author

N70-29146# California Univ., Livermore. Lawrence Radiation Lab.
CONTROL OF MULTIPLE-HEAT SHAKER SYSTEMS: AN APPLICATION OF LINEAR ALGEBRA

R. H. Wyman 15 Jan. 1970 6 p refs Presented at 16th Ann. Meeting and Equipment Exposition, Boston Submitted for publication Sponsored by AEC Revised
(UCRL-71927-Rev-1; Conf-700402-1) Avail: CFSTI

Contemporary control schemes for multiple-head shaker systems have been implemented with little understanding of the nature of the problem. This paper presents the theory of these systems as an application of linear algebra and shows how the theory may be reduced to practice in a modified open-loop control system. Author

N70-29149# Brookhaven National Lab., Upton, N.Y.
USERS' MANUAL FOR GENASY: AN OFF-LINE ASSEMBLER FOR THE VARIAN 620/i COMPUTER
N. E. Greenlaw, E. L. Mc Guire, and S. W. Weingart Dec. 1969 54 p
(BNL-14337) Avail: CFSTI

The GENASY off-line assembler is written in FORTRAN and designed to run on the CDC 6600. It recognizes, and correctly assembles, all machine instructions recognized by Varian's assembler, DAS, but it does not allow all of the DAS pseudo-ops. The pseudo-op facilities of GENASY are described. GENASY was designed to run in two stages. Stage 1, on the CDC 6600, produces a complete listing of the assembled program and a magnetic tape. This tape is then sent to the CDC 924 for stage 2, which produces the paper tape object program. GENASY can operate in either of two modes: the absolute mode, and the relocatable mode. Author

N70-29168# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
SECOND VERSION OF THE GAMBIT CODE
G. Collier, Gordon Gibson, L. L. Moran, R. K. Disney, and R. S. Kaiser Nov. 1969 95 p refs
(WANL-TME-1969) Avail: CFSTI

The changes involved in the second version of the GAMBIT computer program are described. Results of six sample problems are included. Input instructions are listed. NSA

N70-29172# General Electric Co., St. Petersburg, Fla. Neutron Devices Dept.
THE MATHATRON DESKTOP COMPUTER/CALCULATOR WITH APS MODULE
W. H. Buck 19 Aug. 1969 87 p refs
(Contract AT(29-2)-656)
(GEPP-70) Avail: CFSTI

An explanation of the Mathatron Auxiliary Program Storage Unit (APS) is provided. The APS is a greatly expanded version of the basic 8-48 Mathatron. The following features of the APS module provide the capability of handling complex problems that formerly required the use of a large computer: 1) the program steps are increased from 48 to 480, 2) the storage registers are increased from 8 to 48, 3) any subroutine may be used as many times as required by the master program, and 4) decisions can be made dependent on a calculated negative or positive result. Author

N70-29186# New England Inst. for Medical Research, Ridgefield, Conn.
FAST-FAST COINCIDENCE DUAL RANGE TIME-TO-AMPLITUDE CONVERTER SYSTEM
S. J. Tao Nov. 1969 14 p refs
(Contract AT(30-1)-3661)
(NYO-3661-27) Avail: CFSTI

A fast-fast coincidence time-to-amplitude system with two time-to-amplitude converters, one of range 40 nsec and another, 400 nsec, is described. This system is found to be very useful in the determination of positron annihilation lifetime spectrum in non-condensed materials where a long range and a good resolution are both required. By using this system both the memory space required and the labor for data reduction are considerably reduced. Author (NSA)

N70-29203# Iowa State Univ. of Science and Technology, Ames.
PHYSICS USE OF THE AMES LABORATORY ON-LINE MEASURING SYSTEM FOR BUBBLE CHAMBER EVENTS
T. L. Schalk and W. J. Kernan Dec. 1969 14 p refs
(Contract W-7405-eng-82)
(IS-2231) Avail: CFSTI

The use of the Ames Laboratory on-line measuring system for bubble chamber events is described using the measurement of Vee events in antiproton, proton experiments at 2.4 and 2.9 GeV/c as an illustration. Simplified flow charts of the control routines and systems are presented. The physics basis of the design is shown and discussed. Author (NSA)

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors, integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N70-27813# Stanford Univ., Calif.
THE USE OF TRANSISTORS AS BROADBAND VOLTAGE-VARIABLE TIME DELAYS
E. L. Skuldt Sep. 1969 63 p refs
(Contract Nonr-225(59))
(AD-702015; SU-SEL-69-067; TR-1974-2) Avail: CFSTI CSCL 9/5

A mathematical model is developed that describes the variable time-delay performnce of a high-frequency transistor amplifier. Time-delay change is achieved by voltage variation of the minority-carrier transit time and the collector capacitance of the transistor. A figure of merit clarifies the relationship between time delay and amplifier bandwidth and is used to obtain maximum utilization of the voltage-variable transistor parameters. Other delay techniques, specifically the LC lumped approximate transmission-line section, provide voltage-variable continuous time delay, using only a variable capacitance. Comparison between the transistor and LC techniques shows that using changes in transit time of ordinary HF transistors offers little advantage over the LC technique. Author (TAB)

N70-27884# Aerospace Corp., El Segundo, Calif. Lab. Operations.
A METHOD FOR MEASUREMENTS OF MILLIMETER-WAVE MIXER NOISE FIGURE PARAMETERS Technical Report, Sep. 1968 – Mar. 1969
Wilbur A. Garber 30 Dec. 1969 29 p refs
(Contract F04701-69-C-0066)
(AD-701378; TR-0066(5230-47)-1; SAMSO-TR-70-27) Avail: CFSTI CSCL 9/5

A noise figure measurement system is described that uses the 10-db quieting level of an FM receiver as a reference level for the derivation and measurement of noise figure parameters. Author (TAB)

N70-27913# Resources Development Inst., Greenlawn, N.Y.
MILLIMETER/MICROWAVE RADOME BUILDING BLOCK: A DIELECTRIC SANDWICHED METALLIC CIRCULAR HOLE LATTICE Final Report, 1 Nov. 1968 – 31 Oct. 1969
Edward B. Mc Millan 31 Oct. 1969 77 p refs
(Contract N00014-67-C-0433)
(AD-702121; Rept-93101) Avail: CFSTI CSCL 17/9

Research demonstrated that the building block for an improved millimeter/microwave region radome could be the combination of a strong metal plate perforated with a lattice of circular holes and sandwiched between dielectric layers. Its electrical parameters are those of two sets of shunt inductance and capacitance in parallel connected by series inductance and adjusted to the required shunt impedance and bandwidth. The holes studied were below cut-off. Author (TAB)

N70-27968# Lincoln Lab., Mass. Inst. of Tech., Lexington.
NEGATIVE CONDUCTIVITY IN SOLID STATE AVALANCHE DIODES
Henry Berger 16 Dec. 1969 16 p refs
(Contract AF 19(628)-5167)
(AD-701395; TN-1969-59; ESD-TR-69-409) Avail: CFSTI CSCL 9/1

A new and useful parameter (sigma) for avalanche diodes is obtained which possesses the properties associated with negative conductivity. It is shown how sigma unifies the description of various aspects of device behavior such as diode impedance Z, total current, and the effect of device radius on performance. A greatly simplified, approximate formula for Z is obtained, in terms of sigma, which predicts reasonably well the significant trends, zero-crossings, and peaks. Author (TAB)

N70-28005# Oak Ridge National Lab., Tenn. General Engineering Div.
SUPERCONDUCTIVE ELECTRICAL CONDUCTORS FOR BULK POWER TRANSMISSION
H. K. Walker and F. W. Symonds Oct. 1969 27 p refs
(Contract W-7405-eng-26)
(PB-187233; ORNL-TM-2708) Avail: CFSTI CSCL 09A

The prospect of resistance-free electrical circuits with high capacities has inspired a variety of proposals to capitalize on the effects of superconductivity. One such proposal is to use zero-resistance conductors in loss-free cables for the transmission of bulk electrical power over long distances. The potential for the use of superconductive cable in electrical networks is assessed and the present thinking in this area is examined. The technical feasibility of superconductive cable has been established, but the appropriate time for such cable to be engineered into a functional system has not. When that time comes, the choice will be between direct- and alternating-current systems. At the present, the direct-current system appears to have the advantage because the superconductor can be used under conditions where it is truly loss free. Author (USGRDR)

N70-28009# Amperex Electronic Corp., Hicksville, N.Y.
FEASIBILITY INVESTIGATION OF A NEOTRON IN A CONDUCTION-COOLED SONAR AMPLIFIER MODULE Interim Development Report, 1 Sep. – 15 Nov. 1969
A. Hirtler and D. A. Steen Dec. 1969 24 p
(Contract N00039-69-C-2542)
(AD-700335; IDR-4) Avail: CFSTI CSCL 17/1

The purpose of the program is to conduct an exploratory development of a conduction cooled Neotron (Field Effect Tube) and associated circuitry. The ultimate target of the program is the combination of these developments into a conduction-cooled sonar amplifier module with electrical characteristics similar to the present SQS 23 Sonar Amplifier, but with improved reliability and ease of servicing. Author (TAB)

N70-28011# Sandia Corp., Albuquerque, N.Mex.
SUMMARY OF THE HERMES FLASH X-RAY PROGRAM
T. H. Martin, K. R. Prestwich, and D. L. Johnson Oct. 1969 41 p refs
(SC-RR-69-421) Avail: CFSTI

The Hermes program produced significant information in the areas of Marx generator design, flash X-ray tube development, dielectric breakdown, and general flash X-ray machine design. As an outcome of the Hermes program, Hermes 2 was constructed and is the largest flash X-ray machine presently operating. The results of investigations in the areas mentioned are summarized, and the operation of megavolt flash X-ray machines is discussed. Author (NSA)

N70-28065# Kentucky Univ., Lexington. Dept. of Chemistry.
A PRECISION AUDIO-FREQUENCY VOLTAGE REGULATOR
Dieter Britz, J. S. Jackson, and H. H. Bauer Dec. 1969 13 p refs
(Contract DAAB07-69-C-0366)
(AD-701699; THEMIS-UK-RR-1) Avail: CFSTI CSCL 9/5

A source of precisely known alternating voltages is described. The output remains constant to within 0.1% for variation of plus or minus 40% in the input voltage (frequencies between 30 Hz and 4 kHz). The principle of operation is based on negative feedback, using a light-emitting diode and photosensitive resistor to control the gain. The instrument will serve to increase the accuracy of studies of the behavior of electrochemical cells under applied alternating voltages. Author (TAB)

N70-28114*# Spectrolab, Inc., Sylmar, Calif.
EVALUATION AND TEST OF XENON LAMPS, PHASE 4, VOLUME 1 Final Report
T. L. Hershey and F. N. Benning 24 Apr. 1970 63 p refs
(Contract NAS9-9831)
(NASA-CR-108442) Avail: CFSTI CSCL 09E

Different anode configurations for 20 KW xenon arc lamps were tested and evaluated. These evaluations were used to determine performance characteristics for the lamp and to determine the failure mode, if possible. Special attention was given to the study of the thermal heat transfer characteristics for water cooled copper anodes for such lamps. A method to warn of impending failure of a short arc lamp prior further investigation and promises to lead to a better understanding of the heat transfer properties and may offer a failure warning or malfunction alarm. One lamp was successfully run for a brief period with minute thermocouples embedded within the anode shell. Further, an extensive data collection was made on a second lamp which operated over a wide range of power and anode coolant flow conditions. Author

N70-28159*# Cutler-Hammer, Inc., Deer Park, N.Y.
STUDY OF QUASI-OPTICAL CIRCUIT TECHNIQUES IN VARACTOR MULTIPLIERS
Erich H. Kraemer, Jesse J. Taub, Gerard V. Kopcsay, and Gediminas P. Kurpis Mar. 1970 101 p refs
(Contract NAS12-625; Proj. 4416)
(NASA-CR-86391) Avail: CFSTI CSCL 09E

Circuit techniques applicable to quasi-optical multipliers operating at millimeter wavelengths has been studied. Circuit development and experimental results are emphasized. A directional filter, tuner, and reflectometer were developed, and evaluation showed them to be adequate for use with experimental 30- to 60-GHz varactor multiplier mounts. This included focused varactor mounts, planar and linear varactor arrays. Several of the varactor mount concepts showed promise, but high efficiency (10 percent or greater) was never obtained because of the use of encased varactors and inadequate cutoff frequencies. The increasing availability of unencapsulated varactors, together with cutoff frequencies in the 700- to 1000-GHz region, should increase the efficiency to about 50 percent with the techniques described herein. Author

N70-28243*# General Electric Co., Binghamton, N.Y. Avionic Controls Dept.
BRUSHLESS dc MOTOR AND CONTROLLER Final Report, Sep. 1969 – Mar. 1970
B. H. Hertzendorf and E. W. Mantauffel Mar. 1970 43 p ref
(Contract NAS8-25085)
(NASA-CR-102675; ACD-9854) Avail: CFSTI CSCL 09E

The design, fabrication, and functional testing of two brushless dc motors with split windings which can be connected in either a series or parallel configuration are discussed. In a parallel configuration the motors are capable of operation at speeds of 1040 rpm and torque levels of 3.35 ft-lbs. In a series configuration the motors can operate at 520 rpm and 6.70 ft-lbs. One set of drive electronics was designed and fabricated to power the motors. The drive electronics have the unique capability of returning power to the supply when the motor is deaccelerated while operating at high speeds. Author

N70-28295# Naval Research Labs., Washington, D.C.
ELECTRONICS: PROBLEM NOTES
In its Rept. of NRL Progr. Mar. 1970 p 27 - 29 refs (See N70-28291 14-34)
Avail: CFSTI

Research in the field of electronics is reported and includes: (1) An evaluation of cold test interaction circuits for Traveling Wave Tubes (TWTs). Circuit dispersion and interaction impedance were measured on four types of circuits being considered for high-power TWT design. A comparison of the performance of the four cold test models indicate that the convection cooled structure should be strongly considered because of its dispersion and gain characteristics. (2) The effects were studied of neutron irradiation on the band structure of group III - V compound films. A significant result of the research was the discovery that the selfsame shifts of the fundamental energy gap observed in films deposited at low substrates can be produced by neutron irradiation. D.L.G.

N70-28419*# Motorola, Inc., Scottsdale, Ariz. Government Electronics Div.
FINE SUN SENSOR-SIGNAL CONDITIONER Final Report
Ken Eme 18 Mar. 1970 66 p
(Contract NAS8-30033)
(NASA-CR-102674) Avail: CFSTI CSCL 09E

The signal conditioner of the fine sun sensor furnishes remote indication of positioning data to the spacecraft computer by receiving pitch and yaw axis signals along with a zero pulse input. The mechanical configuration of the logic system is described and fabrication problems are discussed. A worst case analysis of the logic design is included. R.B.

N70-28570# Admiralty Oil Lab., Cobham (England).
INVESTIGATIONS OF FIELD EFFECT TRANSISTORS AT CRYOGENIC TEMPERATURES
George B. Craig and Steve S. Sesnic 12 Jan. 1970 84 p refs
(Grant AF-AFOSR-0766-67)
(AD-702464; TM-16; AFOSR-70-0549TR) Avail: CFSTI CSCL 9/1

Various JFET and MOSFET devices have been studied at LN and L He temperatures. A strong increase in transconductance and decrease in equivalent input noise is registered when the ambient temperature changed from 300K to 77K. A very small change in electrical parameters of the device was noticed when the environment temperature was further lowered to 4.2K. Transient and steady state heating of the devices at 4.7K is investigated and it is found that the active part of the device heats up typically to a steady state value of 40 - 60K. In most of the devices this agrees with the thermal noise observed. A transient and steady state device heating model is constructed and the results are found to be in good agreement with the measured temperatures and measured heating transients. The equivalent input noise studies for a germanium FET device have shown a strong 1/F-noise for frequencies up to approximately 100 kHz and thermal noise for higher frequencies. At cryogenic temperatures JFET devices show a slight decrease in noise spectrum. The noise spectrum of the MOSFET devices in most cases is by an order of magnitude larger than that of the JFET device. Some of the MOSFET devices show a substantial increase in noise at lower frequencies when the environment temperature is lowered to a cryogenic level. Author (TAB)

N70-28744# General Electric Co., St. Petersburg, Fla. Neutron Devices Dept.
DESIGN EQUATIONS FOR A CURRENT BALANCING CHOKE
J. C. Roubik 18 Nov. 1968 27 p
(Contract AT(29-2)-656)
(GEPP-76) Avail: CFSTI

The minimum current balancing choke inductance, which is required to achieve a specific level of circuit isolation and response fidelity, can be determined by using the equations given in this report. These equations are intended for direct choke design, and they may be used for verification of the effectiveness of existing intuitive designs. Equivalent circuit response equations are also presented, and they provide an insight into the operation of the choke. A practical design example is given to show the use of the design equations. Author

N70-28788*# Maryland Univ., College Park. Dept. of Physics and Astronomy.
TIMEKEEPING FOR THE LASER RANGING EXPERIMENT AT MC DONALD OBSERVATORY
S. K. Poultney 1 Sep. 1969 20 p refs Submitted for publication
(Grant NGR-21-002-109)
(NASA-CR-110207; TR-70-021) Avail: CFSTI CSCL 09E

The basic clock and time synchronization devices are considered applied to the ranger lunar probes, along with the layout and monitoring equipment. Procedures for frequency calibration using a VLF receiver are summarized, and the synchronized time code generator using the falling edge of 1-pps pulse to trigger an oscilloscope is assessed by the tick phasing method. Several battery packs were provided as standby power provisions to keep frequency standard clocks operable. Problems in the timekeeping system are briefly mentioned. J.A.M.

N70-28790*# Maryland Univ., College Park. Dept. of Physics and Astronomy.
THE CONCEPT OF THE TIME INTERVAL MEASUREMENT AND CONTROL CIRCUITRY FOR THE LUNAR RANGING EXPERIMENT: A HISTORY
S. K. Poultney Dec. 1969 47 p refs
(Grant NGR-21-002-109)
(NASA-CR-110146; TR-70-68) Avail: CFSTI CSCL 09E

The concept of the time interval measurement and control circuitry for the Lunar Ranging Experiment prior to January 1969 is recorded. The suggested components of the system are also given. Author

N70-28793*# Maryland Univ., College Park. Dept. of Physics and Astronomy.
PRECISION TIMING WITH PHOTOMULTIPLIERS AT THE SINGLE PHOTOELECTRON LEVEL Interim Report
S. K. Poultney Aug. 1968 25 p ref
(Grant NGR-21-002-109; Contract DAHC04-67-C-0023)
(NASA-CR-110206; TR-862) Avail: CFSTI CSCL 09E

The precision timing in the subnanosecond region using currently available photomultipliers and fast electronic equipment is examined at both moderate light levels and the single photoelectron level. A one nanosecond distance was measured using a light pulse three nanoseconds wide and of such an intensity as to yield not more than one photoelectron each pulse. In addition, the location of the single photoelectron level and the behavior of dark current at this level are discussed. Author

N70-28875# Toulouse Univ. (France). Faculte Des Sciences.
CARRIERS LIFETIME EVOLUTION IN JUNCTION DIODES IRRADIATED BY HIGH ENERGY PROTONS [EVOLUTION DE LA DUREE DE VIE DES PORTEURS DANS LES DIODES A JONCTION IRRADIEES PAR DES PROTONS DE GRANDE ENERGIE]
Jean Bielle (Ph.D. Thesis) 2 Mar. 1970 185 p refs In FRENCH; ENGLISH summary
(Contracts CEA-DAM-1134/R; CEA-DAM-1408/R; CEA-DAM-1700/R; CNES-420(1965))
Avail: CFSTI

The effects of 5.5 and 3000 MeV protons, and 4.5 MeV electron radiations on carrier lifetime were studied using different types of junction diodes and solar cells. Lifetime evolution was analysed as functions of the technical characteristics of the devices, silicon properties, carrier injection rate, and the types of defects introduced. A new equivalence concept for lifetime degradation, based on the structure of the defects, can be used to group the effects of the different energies of the incident particles. Author (ESRO)

N70-28882# National Bureau of Standards, Boulder, Colo. Radio Standards Engineering Div.
A PRECISION, HIGH FREQUENCY CALIBRATION FACILITY FOR COAXIAL CAPACITANCE STANDARDS
R. N. Jones and L. E. Huntly Mar. 1970 30 p refs
(NBS-TN-386) Avail: SOD $0.35

Using high frequency impedance standards which are fitted with precision coaxial connectors, and limiting calibrations to specific frequencies and impedance values, can contribute greatly toward improving measurement agreement and standardization. These advantages have been utilized in the development of a new and much improved calibration service for capacitance in the high frequency region. The service is for capacitances of 50, 100, 200, 500 and 1000 picofarads at 100 kHz, 1 MHz, and 10 MHz. Descriptions are given for the instrumentation used in the measurements and the method of data handling, and gives a detailed breakdown of the measurement uncertainties. Author

N70-28946# Saclant ASW Research Center, La Spezia (Italy).
A CABLE GLAND FOR DEEP OCEAN OPERATION
Bruno Miaschi 15 Mar. 1970 18 p
(TM-149) Avail: CFSTI

An underwater multi-cable gland used for connecting sensors subject to hydrostatic pressure to electronic equipment located in pressure-resistant containers is described. In its present form the gland is for use only with neoprene or rubber sheathed cables. Samples of the assembly have been in regular operational use at water depths down to 3600 m during the last two years. Author (ESRO)

N70-29051# Siemens A.G., Munich (West Germany).
COMMUNICATIONS SATELLITE. PART 4: DEVELOPMENT WORK ON ACTIVE AND PASSIVE COMPONENTS [NACHRICHTENSATELLIT. BAND 4: ENTWICKLUNGSARBEITEN AN AKTIVEN UND PASSIVEN BAUELEMENTEN]
Apr. 1970 140 p refs In GERMAN; ENGLISH summary
Sponsored by Bundesmin. fuer Bildung und Wiss.
(BMBW-FB-W-70-15) Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 29 DM

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N70-29052# Siemens A.G., Munich (West Germany).
TRANSISTORS FOR CARRIER WAVE SUPPLY [TRANSISTOREN FUER TRAEGERVERSORGUNG]
H. Dorendorf and W. Henning *In its* Commun. Satellite, Pt. 4: Develop. Work on Active and Passive Components Apr. 1970 p 6 - 25 refs In GERMAN (See N70-29051 14-09)
Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 29 DM

A transistor BFX 57 S developed for communication satellite purposes, is described. It is manufactured by silicon epitaxial planar techniques and can be used as a small-signal/small-power stage in the basic 250 MHz oscillator, and as a DC preamplifier state in the voltage regulator of the power supply circuit. Thus the transistor performs well at both high and low frequencies. High energy particle radiation has little effect on it. Durability tests are still in progress. Author (ESRO)

N70-29053# Siemens A.G., Munich (West Germany).
TRANSISTORS FOR INTERMEDIATE FREQUENCY AMPLIFIERS [TRANSISTOREN FUER ZF-VERSTAERKER]
H. Dorendorf and W. Henning *In its* Commun. Satellite, Pt. 4: Develop. Work on Active and Passive Components Apr. 1970 p 26 - 44 refs In GERMAN (See N70-29051 14-09)
Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich 29 DM

A transistor, BFW 99 S, for use in intermediate frequency amplifiers, is described. It is a M-P-M transistor manufactured with silicon-planar techniques for ultrahigh frequencies. Electrical durability tests and the fabrication method are described. Reduction of the number of emitter-basis short circuits is now necessary. Author (ESRO)

N70-29054# Siemens A.G., Munich (West Germany).
TRANSISTORS FOR POWER SUPPLY [TRANSISTOREN FUER DIE STROMVERSORGUNG]
H. Dorendorf *In its* Commun. Satellite, Pt. 4: Develop. Work on Active and Passive Components Apr. 1970 p 45 - 55 refs In GERMAN (See N70-29051 14-09)
Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 29 DM

Three silicon-planar power transistors, which can be used for communications satellite power supply purposes, are described. They are radiation resistant, their breakdown voltages are high, and their reliability was improved by ultrasonic welding of the electrical contacts. Author (ESRO)

N70-29055# Siemens A.G., Munich (West Germany).
VARACTOR DIODES FOR FREQUENCY MULTIPLIERS [VARAKTORDIODEN FUER FREQUENZUERVIELFACHUNG]
G. Kesel *In its* Commun. Satellite, Pt. 4: Develop. Work on Active and Passive Components Apr. 1970 p 56 - 74 refs In GERMAN (See N70-29051 14-09)
Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 29 DM

Several types of silicon varactor diode were manufactured with planar epitaxial techniques. Diodes with steeper characteristics were developed in attempts to make them suitable for frequency

multiplication of up to 27 times. The components were tested for electrical, thermal and mechanical reliability and also radiation resistance. Author (ESRO)

N70-29056# Siemens A.G., Munich (West Germany).
TUNNEL DIODE FOR THE LOW-NOISE PREAMPLIFIER [TUNNELDIODE FUER DEN RAUSCHARMEN VORVERSTAERKER]
G. Kesel *In its* Commun. Satellite, pt. 4: Develop. Work on Active and Passive Components Apr. 1970 p 75-91 refs In GERMAN (see N70-29051 14-09)
Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 29 DM

Based on the experience gained with n-germanium tunnel diodes, a new p-germanium planar tunnel diode was developed. It is used in the communication satellite transponder on the receiving end, between antenna and step-down mixer. The working frequency of the tunnel diode amplifier lies between 5925 and 6425 GHz and the bandwidth is 500 MHz. Author (ESRO)

N70-29057# Siemens A.G., Munich (West Germany).
THIN FILM TECHNIQUE [DUENNSCHICHTTECHNIK]
H. Heywang *In its* Commun. Satellite, Pt. 4: Develop. Work on Active and Passive Components Apr. 1970 p 92-114 refs In GERMAN (See N70-29051 14-09)
Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 29 DM

Thin film hybrid circuits are suitable for communication satellites because of their lower weight, volumes, and higher reliability. They are used in the intermediate frequency amplifiers for 250-500 MHz and 500-750 MHz, and the regulating circuit of the main voltage regulator in the satellite transponder. The manufacture of thin film circuits is described. Author (ESRO)

N70-29058# Siemens A.G., Munich (West Germany).
STACK CAPACITORS [STAPELKONDENSATOREN]
H. Heywang *In its* Commun. Satellite, Pt. 4: Develop. Work on Active and Passive Components Apr. 1970 p 115-138 refs In GERMAN (See N70-29051 14-09)
Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 29 DM

A description is given of the manufacturing processes and electrical properties of ceramic capacitors in a stack. Some details of their reliability are also given. Author (ESRO)

N70-29089# Kentucky Univ., Lexington. Dept. of Chemistry.
USE OF A COMMERCIAL LOCK-IN AMPLIFIER IN PHASE-SELECTIVE SECOND-HARMONIC ac POLAROGRAPHY Interim Scientific Report
Henry H. Bauer and Dieter Britz Dec. 1969 9 p refs
(Contract DAAB07-69-C-0366; Proj. Themis)
(AD-701703; THEMIS-UK-RR-4) Avail: CFSTI CSCL 14/2

Lock-in amplifiers are now quite commonly used in a. c. polarography. The same units can be used for the measurement of higher harmonics. Several possible ways of using one such unit for second-harmonic studies are discussed, and one technique recommended. Author (TAB)

N70-29144# Yale Univ., New Haven, Conn. Hammond Lab.
MAGNETIC SUSCEPTIBILITY MEASUREMENTS WITH A TUNNEL DIODE OSCILLATOR
R. B. Clover and W. P. Wolf [1969] 25 p refs Supported in part by AEC
(YALE-3227-62) Avail: CFSTI

A tunnel diode oscillator is described which has been successfully used for paramagnetic susceptibility measurements at frequencies from 2 MHz to 55MHz, at temperatures from 1.2 K to 77 K and at magnetic fields up to 18 kG. Author

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories.

N70-27819# Aerospace Corp., El Segundo, Calif. Electronics Research Lab.
RESEARCH ACTIVITIES IN THE ELECTRONICS RESEARCH LABORATORY
LaRue A. Hoffman 30 Nov. 1969 94 p refs
(Contract F04701-69-C-0066)
(AD-702433; TR-0066(5230-01)-2; SAMSO-TR-70-60) Avail: CFSTI CSCL 9/1

The report is a brief history of the research efforts and accomplishments of the Electronics Research Laboratory of the Aerospace Corporation, 1963 to 1969. Included are highlights from the areas of millimeter-wave research, solid-state research, infrared devices and techniques, and laser physics and applications research. Author (TAB)

N70-28081*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Astrionics Div.
RELIABILITY MODELING AND ANALYSIS OF A DYNAMIC TMR SYSTEM USING STANDBY SPARES
F. P. Mathur 1 Nov. 1969 14 p refs Presented at the 7th Ann. Allerton Conf. on Circuit and System Theory, Urbana, Ill., 8-10 Oct. 1969
(Contract NAS7-100)
(NASA-CR-109961; JPL-TR-32-1467) Avail: CFSTI CSCL 09C

A dynamic TMR (triple modularly redundant) system using standby spares, referred to as the TMR/Spares system, is developed, modeled, and analyzed. The characteristic reliability equation of such a system is derived. The behavior of the system reliability as a function of the nonredundant system and normalized time is plotted and comparisons are made with conventional TMR systems. The TMR/Spares model is considered to be a major addition to the redundancy techniques available to the designer of fault-tolerant computers. Author

N70-28101*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Guidance and Control Div.
MINIMUM ENERGY CONTROL OF A CLASS OF ELECTRICALLY DRIVEN VEHICLES
Y. E. Sahinkaya 1 May 1970 40 p refs
(Contract NAS7-100)
(NASA-CR-109963; JPL-TR-32-1471) Avail: CFSTI CSCL 09C

An automatic speed controller was designed and built for a class of electrically driven vehicles according to the theoretical concepts determined by the application of modern control theory. The theoretical and practical results given were originally aimed at the design and development of an automatic speed controller for lunar-roving vehicles. For the vehicle considered, each wheel is driven by a permanent-magnet dc motor whose speed is governed by a controller with the following operational characteristics: (1) The controller accelerates or decelerates the vehicle to the desired speed in response to a command-signal fed into the system by the throttle mechanism in the presence of vehicle disturbances caused by terrain slope changes. (2) The controller maintains a constant vehicle speed at the desired value in the presence of terrain slope changes. (3) The controller accomplishes the above by using a minimum amount of battery energy for the motor armature circuit during acceleration, and by feeding a maximum amount of energy from the motor armature circuit to the battery during deceleration. Author

N70-28119*# Mathematical Sciences Group, College Park, Md.
A PROGRAM FOR INTERACTIVE COMPUTATION IN LINEAR SYSTEMS THEORY Final Report

Thomas S. Englar May 1970 58 p refs
(Contract NAS12-583)
(NASA-CR-86355) Avail: CFSTI CSCL 09C

A computer program is described for use in the analysis and design of linear dynamical systems. The program is written in FORTRAN 4 for use on remote terminals which access a time-shared, conversational computer system. The intent has been to have a structure in which arbitrary subroutines could be used, their output monitored, parameter changes made, and the process repeated until a satisfactory conclusion has been reached. To mechanize these aims an interpretive program was set up which requests commands from the user and operates upon data stored in the machine. The first stage of programming constructed a basic set of subroutines for manipulating constant matrices. The second stage would have performed the same task for matrices whose elements are ratios of polynomials. Only a beginning has been made on this task. In addition some vector space operations, using matrices to represent spaces, have been made available. These mechanize the operations required in the Wonham-Morse geometric approach to the decoupling problems. Author

N70-28167# ARINC Research Corp., Annapolis, Md.
INITIAL STUDY FOR THE DEVELOPMENT OF A RELIABILITY-PREDICTION TECHNIQUE FOR MONOLITHIC INTEGRATED CIRCUIT
E. W. Dishman, J. D. Reese, and S. S. Schneider Oct. 1969 40 p
(Contract N00039-69-C-3527)
(AD-702400; Rept-912-01-1-1002) Avail: CFSTI CSCL 14/4

The report presents the results of a study to determine the feasibility of developing a reliability-prediction technique for integrated circuits. The proposed prediction technique is intended to be based upon statistical analysis of data collected from manufacturers and users of integrated circuits. The principal aim of the study described here was to determine whether the proposed prediction technique can be supported by the integrated-circuit reliability data that have been recorded and retained by organizations involved in integrated-circuit applications. A list of the significant reliability-influencing variables was prepared and the feasibility of developing prediction equations based on a regression analysis of these variables from the data available has been established. Author (TAB)

N70-28229 Virginia Polytechnic Inst., Blacksburg.
REALIZATION OF ELLIPTIC FILTERS USING ACTIVE RC NETWORKS
Gerald Ewing Roberts (Ph.D. Thesis) 1969 156 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 69-19983

Several methods were investigated for designing active filters having prescribed attenuation requirements. Developments in the areas of filter theory and active network realizations include: (1) A direct method is described of approximating and deriving functions required in the design of both passive and active filters. Based on these results, the analytic basis for reducing filter specifications to design information compatible with the approximating function is outlined. (2) A simplified method of factoring Chebyshev type polynomials arising in filter design is described. (3) A flexible low-pass to bandpass transformation is described for even order low-pass filter which is an extension of the low-pass to low-pass transformations used to obtain attenuation poles at infinity. (4) Two active resonators were developed, one resonator produces a pure resistive input impedance while retaining the required transfer function. The other produces a transfer function having zeros independent of the poles in order to realize easily-tunable poles on either side of the pass band of a bandpass filter. Two examples of bandpass filter design using these two types of resonators are given. Dissert. Abstr.

N70-28347# Polytechnic Inst. of Brooklyn, Farmingdale, N.Y.
REVIEW OF SOME RECENT DEVELOPMENTS IN THE SYNTHESIS OF RATIONAL MULTIVARIABLE POSITIVE REAL MATRICES Interim Report
Dante C. Youla Jan. 1970 46 p refs
(Contract F30602-69-C-0053)
(AD-700351; PIBEP-69-045; RADC-TR-69-428; IR-2) Avail: CFSTI CSCL 9/5

An in depth review of recent developments in the Synthesis of Rational Multivariable Positive Real Matrices is presented. A conjectured Factorization Theorem is discussed along with some of its implications, if true, in the formation of constructive synthesis procedures for Multivariable Networks. Some topological constraints needed to insure practical realization are suggested. Author (TAB)

N70-28542*# Houston Univ., Tex.
INVESTIGATION OF ARCSINE DEVICES FOR PHASE MODULATION PRODUCT DETECTOR APPLICATIONS, PART 3 Final Report
N. M. Shehadeh and Russell H. Pacey, Jr. 11 Mar. 1970 57 p refs
(Contract NAS9-9270)
(NASA-CR-108452) Avail: CFSTI CSCL 09C

Functional models capable of performing the arcsine function are investigated for possible application to phase modulation receivers utilizing product detection. A mathematical model of one of these functional models is developed, and its performance in terms of output versus input signal-to-noise ratio is investigated. Modulation by a single sinusoid is considered for the case of an additive, white, Gaussian noise process, and both analytical and computer simulation techniques are utilized in determining the performance characteristics of the model. It is shown that the analytical results are valid for only a very limited case. Results from the computer simulation indicate that for the model to be of any practical worth, the modulation index must be small while input signal-to-noise ratio must be relatively high. Author

N70-28706*# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
PARAMETER IDENTIFICATION AND STATE ESTIMATION FOR LINEAR SYSTEMS
Michael A. Budin Jan. 1970 87 p refs Sponsored in part by NSF
(Grant NGR-05-020-019)
(NASA-CR-110181; SUDAAR-392) Avail: CFSTI CSCL 09C

The problems of identifying the parameters and estimating the states of multiple input, multiple output, linear, time-invariant systems are discussed. Various structural features of linear systems are utilized to obtain estimators which are computationally practical, have few restrictive conditions, and have satisfactory convergence behavior. Author

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N70-27868# Institute of Nuclear Research, Warsaw (Poland).
THE BEAM SWITCHING MAGNET SYSTEM FOR THE VAN de GRAAF ACCELERATOR LECH [UKLAD ROZDZIELANIA WIAZKI JONOW AKCELERATORA ELEKTROSTATYCZNEGO LECH]

A. Bienkowski, E. Gorski, M. Jaskola, H. Rekawek, and L. Zemlo 1968 31 p refs In POLISH; ENGLISH summary
(INR-971) Avail: AEC Depository Libraries

The construction and mounting of the beam switching magnet with power supply and the beam position stabilizer are described. Author (NSA)

N70-27910# Naval Postgraduate School, Monterey, Calif.
A WIND TUNNEL INVESTIGATION OF THE HYDRODYNAMIC STABILITY OF A MANNED UNDERWATER STATION IN OCEAN CURRENTS
Robert Louis Ditchey (M.S. Thesis) Oct. 1969 98 p refs
(AD-702068) Avail: CFSTI CSCL 13/10

The hydrodynamic stability of an underwater stations was studied using wind tunnel models. Rigid model force and moment coefficients were obtained for various orientations of the station in three dimensions. The unsteady motion of the station in cross currents was investigated with a dynamically similar model. Color 8mm pictures and amplitude-time traces of the unsteady motion were obtained. Author (TAB)

N70-28094*# Physics International Co., San Leandro, Calif.
HIGH-VELOCITY EXPLOSIVELY DRIVEN GUNS
J. D. Watson Washington NASA Jun. 1970 111 p refs
(Contract NAS2-4903)
(NASA-CR-1533; PIFR-113) Avail: CFSTI CSCL 14B

A two-stage gun was used to launch intact 2-g models to 12.2 km/sec in several experiments. A single-stage gun was developed to accelerate 2-g models to 12 km/sec; it has a lower velocity limit and the peak projectile base pressures generated are considerably higher than those produced in the two-stage device. The performance limits of the one- and two-stage guns are discussed. In the two-stage gun, the design problems associated with the first stage were resolved; however, unfavorable operation of the second stage has prevented higher velocities from being achieved. In particular, the second-state explosive lens was operated in an asymmetric mode for ease of fabrication and instrumentation. The asymmetric collapse of the barrel to form the second-stage piston appeared not to be complete and the anticipated performance was not achieved. In support of the experimental work sections on current explosive driver design criteria, a discussion of gasdynamic cycles for achieving high velocities, and a calculational method to predict explosive gun performance, are included. Author

N70-28204# International Atomic Energy Agency, Vienna (Austria).
IAEA LABORATORY ACTIVITIES Technical Report
Sep. 1968 154 p refs *Its* Series No. 90
(STI/DOC-10/90) Avail: AEC Depository Libraries

This fifth report describes development and work during the year 1967. It included activities of the IAEA Laboratories at Vienna and Seibersdorf, the International Laboratory of Marine Radioactivity at Monaco, the International Centre for Theoretical Physics at Trieste, and the Middle Eastern Regional Radioisotope Center for the Arab Countries at Cairo. Author

N70-28375# Ceskoslovenska Akademie Ved, Rez. Ustav Jaderneho Vyzkumu.
THE EFFECT OF INSULATOR SHAPE ON THE ELECTRIC STRENGTH OF A SECTION OF ACCELERATING TUBE IN A VAN de GRAAFF ACCELERATOR
R. Dzmuran Sep. 1969 42 p refs
(UJV-2262-A) Avail: AEC Depository Libraries

Results of the tests of the effect of the insulator internal wall shape on the dielectric-strength of the gap in the accelerating tube are reported. The experiments were aimed to investigate the behavior of the gaps in the whole load range and to obtain the results which could be used in actual applications. Even though the results are affected by a number of parameters which were not studied, they show clearly that the insulator shape affects essentially the dielectric strength of the gap conditioning rate and efficiency, current load in the conditioning process, and the gap life. Author (NSA)

N70-28426# Tri-Univ. Meson Facility, Vancouver (British Columbia).
CONCEPTUAL DESIGN STUDY FOR THE VACUUM PUMPING SYSTEM FOR A 500 MEV H(-) CYCLOTRON
R. G. Blakely, R. W. Moore, Jr., and Vivienne J. Harwood Aug. 1969 142 p refs
(TRI-69-9) Avail: AEC Depository Libraries

The conceptual design study of the vacuum pumping system for the TRIUMF cyclotron considers two different pumping systems in detail: large trapped oil diffusion pumps, and 20 K cryopumps with auxiliary trapped oil diffusion pumps. The pumping systems are compared in relation to certain criteria. These include an equivalent nitrogen stripping cross-section pressure of 7×10 to the -8th power Torr within 15 hours of pumping, minimum contamination of the vacuum chamber, and compatibility with other cyclotron components. Reliability, maintenance and test requirements have received particular attention, since cryopumping has not been widely used as a pumping method for an accelerator. A discussion of outgassing rate data of materials and an analysis of the gas loads for the cyclotron are included. Gauging and leak-testing methods for the vacuum chamber and pumping system are described. Estimates of capital and annual operating costs for the two pumping systems are provided, and a construction schedule is presented. Author (NSA)

N70-28482# Deutsche Gesellschaft fuer Luft- und Raumfahrt, Porz (West Germany).
REPORT ON THE MEETING OF THE SCIENTIFIC COMMITTEE ON MEASUREMENT TECHNIQUES ON JET ENGINE TEST FACILITIES [BERICHT UEBER DIE ARBEITSTAGUNG DES DGLR-FACHAUSSCHUSSES AERODYNAMISCHE MESSTECHNIK]
May 1969 39 p In GERMAN; ENGLISH summary Conf. held at Ottonbrun, West Ger., 25 – 26 Feb. 1969
(DLR-Mitt-69-15) Avail: CFSTI

The following subjects were discussed: optical temperature measurement, especially line reversal methods; high temperature probes; heat transfer in hot gases and in the cryogenic region; possibilities of compensation on dynamic measurements; flow measurements; inclusion of previous knowledges in examination-planning and critical examination of samples. Author

N70-28552# Akademiya Nauk URSR, Kharkov. Fiziko-Technicheskii Inst.
DEVELOPMENT AND CONSTRUCTION OF MAGNETIC SYSTEMS FOR THE "URAGAN" STELLARATOR AND STUDIES OF MAGNETIC SURFACES OF LARGE "LATITUDE"
V. F. Aleksin, O. V. Biryukov, V. N. Vishnevetskii et al 1969 49 p refs In RUSSIAN
(KHFTI-69-39) Avail: AEC Depository Libraries

Magnetic surfaces in toroidal stellarators described in the literature are discussed. An attempt was made of selecting magnetic system parameters for the racetrack stellarator Uragan in order to obtain large-latitude magnetic surfaces. Design and specifications of the stellarator windings as well as the entire magnetic system are discussed. NSA

N70-28564# Gt. Brit. National Inst. for Research in Nuclear Science, Chilton. Rutherford High Energy Lab.
CONSTRUCTION OF MAGNETS FOR PARTICLE ACCELERATOR PHYSICS USING CEMENTATIOUS AGGREGATES

A. T. Gresham, R. Sheldon, and G. B. Stapleton Sep. 1969 8 p refs
(RHEL/R-185) Avail: AEC Depository Libraries; HMSO 1s 9d; BIS $0.40

A technique is proposed for constructing synchrotron and other high energy physics magnets in an integral form using concrete both as an electrical insulator and as a mechanical support. Such structures will overcome the radiation problems encountered in synchrotrons and should prove to be economically attractive. Author (NSA)

N70-28565# Gt. Brit. National Inst. for Research In Nuclear Science, Rutherford High Energy Lab.
DESIGN PROPOSAL FOR A CONCRETE INSULATED MAGNET FOR THE EUROPEAN 300 GeV ACCELERATOR
A. T. Gresham, R. Sheldon, and G. B. Stapleton Oct. 1969 10 p refs
(RHEL/R-184) Avail: AEC Depository Libraries; HMSO 1s 9d; BIS $0.40

A bending magnet suitable for a separated function machine was designed, using concrete insulation for the coils and concrete restraints for the laminated yoke, resulting in an integral prestressed concrete structure. The magnet has the advantage of being unaffected by high energy radiation. Author (NSA)

N70-28566# Dilworth, Secord, Meagher and Associates, Ltd., Toronto (Ontario).
MAGNET CORE CONSTRUCTION CONCEPT FOR A 500 MeV H(-) CYCLOTRON
V. Kiesners Jun. 1969 137 p refs
(TRI-69-5) Avail: AEC Depository Libraries

The construction of the 4000-ton sector magnet cores for the TRIUMF cyclotron is described. The various considerations leading to the optimum design concept are discussed in detail. These include a study of the magnetic properties of commercial steels; the relative advantages of plates, forgings and castings; assembly methods such as bolting and welding; and an assessment of tolerances obtainable by flame cutting and machining. Economy considerations and delivery time have received major attention throughout the study. An important objective was to adapt the design, to the largest possible extent, to the capabilities of Canadian steel manufacturers and fabricators. A construction schedule and a cost estimate ($2,834,000) are included. Author (NSA)

N70-28605 Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Physics.
THE ISOLDE ISOTOPE SEPARATOR
G. Andersson, H. E. Jorgensen (Cern), and K. O. Nielsen (Aarhus Univ.) *In* CERN The ISOLDE Isotope Separator On-Line Facility at CERN 19 Jan. 1970 p 17-30 refs (See N70-28603 14-22)
Copyright. Avail: Issuing Activity

Design criteria of the electromagnetic isotope separator of laboratory size are described. Assembly and testing of the various components of the separator are discussed. Recommendations are made for improving various systems, especially the acceleration voltage in the ion-optical system. R.B.

N70-28608 Copenhagen Univ. (Denmark). Niels Bohr Inst.
BEAM-HANDLING SYSTEM FOR AN ON-LINE ISOTOPE SEPARATOR
A. Lindahl, O. B. Nielsen, and G. Sidenius *In* CERN The ISOLDE Isotope Separator On-Line Facility at CERN 19 Jan. 1970 p 55-61 refs (See N70-28603 14-22)
Copyright. Avail: Issuing Activity

An arrangement is described for on-line measurements of short-lived radionuclides produced in on-line isotope separation in which the ion beam passes through the end plate of the collector chamber and is stopped close to a detector system placed at some distance from the separator. Since the beams are divergent when leaving the isotope separator, the system includes electrostatic lenses capable of refocusing them. Author

N70-28609 European Organization for Nuclear Research, Geneva (Switzerland). Nuclear Physics Div.
THE ISOLDE TARGET SYSTEM
E. Hagebo and S. Sundell *In its* The ISOLDE Isotope Separator On-Line Facility at CERN 19 Jan. 1970 p 63-80 refs (See N70-28603 14-22)
Copyright. Avail: Issuing Activity

The target system for the isotope separator is described in detail, with introductory test experiments that have been performed, and construction and properties of the system during the first years of operation. The target is defined as the whole system for the production of radioactive nuclides, and the target material is the proper element or compound that is irradiated. Author

N70-28626# National Aviation Facilities Experimental Center, Atlantic City, N.J.
EVALUATION OF TAXIWAY CENTERLINE LIGHTING FOR RUNWAY EXITS AND TAXIWAY INTERSECTIONS Final Report Jul. 1967 - Dec. 1969
Cecil B. Phillips May 1970 51 p refs
(FAA-RD-70-15; FAA-NA-70-27) Avail: CFSTI

An evaluation was conducted on green taxiway centerline lighting to determine the feasibility of its continuance across runways to maintain continuity of taxiway guidance and use in runways on short radius curves leading into taxiways for reducing runway occupancy time. It was determined that green taxiway centerline lighting can be used in the surface of runways to provide exit guidance on short radius curves, and continuity of taxiway guidance across runways. By color coding green the three runway centerline lights opposite the throat of a taxiway used for exit purposes, a method of providing visual aids for reducing runway occupancy time resulted. Other findings concerned the need for wide beam fixtures adjacent to intersections consisting of straight sections of centerline lighting, a method of determining the minimum number of fixtures on short straight sections, and a hold bar of three yellow lights spaced 5 feet apart as a minimum adequate configuration for providing an imminence of intersection signal-also applicable for holding aircraft clear of intersecting runways and taxiways. Low-profile green reflectors were found effective as a low cost means of marking curved exits from the runway centerlines into the throats of taxiways for night operations. Author

N70-28633# Addis Translations International, Woodside, Calif.
CRYOGENIC HIGH-FREQUENCY ACCELERATING SYSTEM FOR A RINGOTRON
N. G. Anishchenko et al [1969] 18 p refs Transl. into ENGLISH from the Russian report Transl. for Stanford Linear Accelerator Center
(SLAC-Trans-111; JINR-P9-4722) Avail: CFSTI

The choice of the main parameters of a cryogenic high frequency accelerating system is discussed, and the basic construction elements of the system are described. Preliminary results of an investigation into the high frequency properties of superconductors of the second kind are reported, and technological aspects of the production of superconducting resonator coatings are reviewed. Author (NSA)

N70-28637# Grumman Aircraft Engineering Corp., Bethpage, N.Y. Nuclear and Radiation Physics Section.
FEASIBILITY OF USING A VAN de GRAAFF ACCELERATOR FOR NEUTRON RADIOGRAPHY OF AEROSPACE PARTS
Frank R. Swanson May 1970 18 p refs
(RM-477) Avail: CFSTI

Industrial radiography with thermal neutron beams has gained impetus as the number and complexity of aerospace inspection problems have proliferated. This diagnostic technique is particularly

suitable for viewing organic material (O-rings, circuit boards, bonding agents, etc.) within relatively dense metallic parts, a difficult job for conventional X-ray methods. In view of this inspection capability, the feasibility of using the Research Department's 3 million volt accelerator to produce a radiography-quality thermal neutron beam was investigated. This exploratory work attempted to optimize the thermal neutron yield from a paraffin moderator and to determine practical exposure times. It was concluded that a useful set of radiography parameters can be generated with this source. A practical operating level for this machine appears to be a thermal flux of 100,000 (m/sq cm-sec) with a (gold) cadmium ratio of 4.0 and a flux to gamma dose of 400,000 (m/sq cm-mr) based on a distance of 50 inches from a 1.5 inch diameter collimation aperture. At this distance, gadolinium foil and fine grained film Type AA should require about a half hour exposure. Author

N70-28697*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

DEVICE FOR PRODUCING DYNAMIC DISTORTION PATTERNS AT INLETS OF AIR-BREATHING ENGINES

Robert J. Baumbrick Washington Jun. 1970 25 p refs

(NASA-TM-X-2026; E-5402) Avail: CFSTI CSCL 14B

The servosystem designed to drive the air valve of the device is discussed and the pneumatic system dynamics is analyzed and correlated to experimental results. The pressure distortions at the engine face are brought about through a momentum exchange between primary air flow to the engine and secondary flow produced by the distortion valve. Problem areas that affect jet flow are cited, and corrections are suggested for improving the response. Author

N70-28700# Transtek Associates, Reading, Mass.

STUDY OF THE MAGNETIC FIELD STRUCTURE OF THE TOR-2 STELLARATOR

M. A. Ivanovskii et al Dec. 1969 27 p refs In ENGLISH and RUSSIAN Transl. into ENGLISH of Akad. Nauk SSR, Inst. Fiz. Preprint No. 124 Prepared for Princeton Univ.

(Contract AT(30-1)-1238)

(MATT-Trans-97) Avail: CFSTI

Measurements were made of the magnetic fields by the electron beam method. The measurements were taken in the range of epsilon = B sub 2/B sub 0 from 0.15 to 0.73 (B2 is the amplitude of the helical harmonic, B0 is the longitudinal field). The results are described. NSA

N70-28707*# Chrysler Corp., Huntsville, Ala. Space Div.

APPLICATION OF THE TECHNIQUES FOR EVALUATING THE ACOUSTIC SOURCES OF BACKGROUND NOISE IN WIND TUNNEL FACILITIES

James R. Boone and George F. Mc Canless, Jr. 7 Mar. 1969 98 p refs

(Contract NAS8-20336)

(NASA-CR-102623; HSM-R05-69) Avail: CFSTI CSCL 14B

Acoustic calibration tests were planned for the MSFC 14 in and the AEDC 16 ft transonic wind tunnels. Acoustic calibration testing has been conducted in the MSFC 14 in tunnel. The methods used in these tests are presented. Important results of these tests are discussed and compared with results obtained by other investigators in similar wind tunnels. Based on these results the sources of background noise are enumerated. Recommendations are made to eliminate or reduce the pressure fluctuation generated by these noise sources. Author

N70-28734*# Massachusetts Inst. of Tech., Cambridge. Aerophysics Lab.

DESIGN, CONSTRUCTION, AND EVALUATION OF A MAGNETIC SUSPENSION AND BALANCE SYSTEM FOR WIND TUNNELS Technical Report, Feb. 1966 – Nov. 1969

Timothy Stevens Nov. 1969 187 p refs

(Contract NAS1-4421)

(NASA-CR-66903; MIT-DSR-75396; TR-136) Avail: CFSTI CSCL 14B

The basic design principles of a relatively interaction-free six component magnetic suspension and balance system are defined. The construction of a particular magnet configuration is described. The performance of the magnet configuration is evaluated. The evaluation is based upon parameters measured on the assembled and operating system. The evaluation is extended to a range of system sizes, by use of scaling laws. Design and construction of the required feedback compensation electronics system is described. Design of a five-component model position remote transducer is described. Magnet power supplies and control amplifiers are described, and the performance requirements are related to system size, model configuration, and test conditions. Author

N70-28749# Stanford Linear Accelerator Center, Calif.

TWO-MILE ACCELERATOR PROJECT Quarterly Status Report, 1 Jul. – 30 Sep. 1969

Dec. 1969 65 p refs

(Contracts AT(04-3)-515; AT(04-3)-400)

(SLAC-112) Avail: CFSTI

A status report on a linear accelerator project is presented. Topics included are: (1) accelerator and research area operations, (2) accelerator and research area equipment development, and physics research equipment development. Author (NSA)

N70-28886# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.

MEASUREMENT OF THE ELECTRICAL FIELD IN THE CENTRAL REGION OF THE DUBNA SYNCHROCYCLOTRON BY THE INDUCED CURRENT METHOD

V. P. Pronin and A. N. Safonov 1969 16 p refs In RUSSIAN

(JINR-P9-4851) Avail: AEC Depository Libraries

The components of the electric field in the central region of the Dubna synchrocyclotron have been found by the induced current method which is based on the measurement of charge and current induced on the plates when either a point charge (a charge probe) or a probe vibrating at a constant frequency are placed into the point under investigation. A model in 1:5 scale has been used for measuring the components of the accelerating and electrostatic fields of the dee and the focusing plates in the presence of a beam imitiating the plasma column. The measurement data are tabulated and can be used in calculating particle motion by computer. (NSA)

N70-28887# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.

ON THE OPTIMAL GEOMETRY OF THE SYNCHROCYCLOTRON CENTRAL REGION

V. I. Vinokurov and A. N. Safonov 1969 29 p refs In RUSSIAN; ENGLISH summary

(JINR-P9-4852) Avail: AEC Depository Libraries

The effect of the feeler position screening the semi-circular cut in the dee near the ion source and of the distance to the plates producing additional vertical focusing as well as the influence of their shape for a dee aperture of 8, 12, 18, and 24 cm on the vertical electrostatic forces has been studied. The vertical forces due to the negative bias over the dee and due to the negative potential applied to the focusing electrodes have been measured by using the electrolytic tank with a 1:2 scale model. The plasma of the open ion source and the hood of the closed one are supposed to be at the ground potential. The dependence of the maximum possible particle energy gain per turn upon the orbit radius has been calculated by means of the potential line pattern. The accelerating field has a defocusing effect of the same order of magnitude as that of dee bias. The obtained results can be used for the determination of optimal conditions for acceleration in the cyclotron central region. Author (NSA)

N70-28959# Stanford Linear Accelerator Center, Calif.
THE 3.5 GeV ELECTRON-POSITRON COLLIDING-BEAM INSTALLATION (VEPP-3) Progress Report [SOSTOYANIE RABOT NA USTANOVKE SO VSTRECHNYMI ELEKTRON-POZITRONNYMI PUCHKAMI NA ENERGIYU 3,5 GEV (VEPP-3)]
G. I. Budker et al [1970] 14 p Transl. into ENGLISH from Inst. Nucl. Phys. Novosibirsk Report, 1969 10 p
(SLAC-Trans-109) Avail: CFSTI

The development of the 3.5 GeV electron-positron colliding beam installation VEPP-3 is outlined. The design parameters and construction status of the storage ring, vacuum chamber, high frequency system, synchrotron injector, and beam transport system are summarized. NSA

N70-28979# Los Alamos Scientific Lab., N.Mex.
FABRICATION OF 201.24-MHz DRIFT-TUBE LINAC QUADRUPOLE MAGNETS
E. D. Bush, Jr. 4 Jun. 1969 38 p
(Contract W-7405-eng-36)
(LA-4276) Avail: CFSTI

The fabrication techniques adopted for manufacture of the quadrupole magnets for the drift-tube linac are presented. The resulting magnets have two unique features; they can withstand repeated brazing at 1500 F, and they are highly resistant to radiation damage. Author (NSA)

N70-28994# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehrung.
A DIGITAL MOVING COCKPIT FLIGHT SIMULATOR FOR RESEARCH PURPOSES [DER AUFBAU EINES FORSCHUNGS-FLUGSIMULATORS MIT BEWEGTEM COCKPIT UND DIGITALRECHNER]
Rudolf Dierke Feb. 1970 64 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung
(DLR-Mitt-70-05) Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 13 DM

The characteristics of a flight simulator, using a standard moving cockpit system controlled by a digital computer and used for research into human engineering and flight control, are described. The first stage of the development permits simulation of the instrument flying of aircraft with dynamics similar to those of the Pembroke. Author (ESRO)

N70-29060# Saclant ASW Research Center, La Spezia (Italy).
THE SACLANTCEN METEOROLOGICAL/OCEANOGRAPHIC BUOY
Pierre Blavier, Andre de Haen, Vito Failla, and Riccardo Pesaresi
15 Apr. 1970 27 p
(TM-151) Avail: CFSTI

A 37 m long spar buoy is described which, although primarily intended for specific accurate meteorological measurements, was designed as a very stable and rugged unmanned platform allowing a wide range of oceanographic and meteorological observations. It is equipped with a high-capacity, high-precision data acquisition and digital recording system and is now ready to receive a wide variety of meteorological oceanographic probes in addition to its existing meteorological sensors. It is at present free-drifting but an anchoring device is being studied. At the moment, for operational reasons, the buoy is essentially self-recording, but the present small monitoring transmitter can be replaced by a standard medium-range data transmitting system. Author (ESRO)

N70-29151# Wissenschaftliche Gesellschaft fuer Luft- und Raumfahrt, Munich (West Germany).
PROCEEDINGS OF THE 7th WGLR MEETING ON ROCKET TECHNOLOGY [BERICHT UEBER DIE 7. SITZUNG DES WGLR-FACHAUSSCHUSSES 'RAKETENTECHNIK']
Dec. 1968 156 p refs In GERMAN Conf. held at Ottobrunn, West Ger., 1 Dec. 1968
(DLR-MITT-68-34) Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 32, 34 DM

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N70-29152# Nitrochemie G.m.b.H., Aschau (West Germany).
PROBLEMS OF EXPERIMENTAL SEQUENCE AND FLEXIBILITY OF ROCKET TEST STANDS BASED ON EXPERIMENTS CARRIED OUT AT THE TEST STANDS OF NITROCHEMIE GmbH, ASCHAU [FRAGEN DER VERSUCHSKADENZ UND FLEXIBILITAET VON RAKETENPRUEFSTAENDEN, DISKUTIERT AUF DER GRUNDLAGE DER PRUEFSTAENDE DER NITROCHEMIE GmbH IN ASCHAU]
Legrand *In* WGLR Proc. of the 7th WGLR Meeting on Rocket Technol. Dec. 1968 p 7-10 In GERMAN (See N70-29151 13-11)
Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 32, 34 DM

The Aschau test stand is used for testing solid propellants. The combustion principles and burning behavior of the propellants were investigated and the results of thrust and pressure measurements from several test firings are given. ESRO

N70-29153# Institut fuer Chemie der Treibstoffe, Berghausen (West Germany).
TEST STANDS FOR SOLID ROCKET PROPELLANTS NOTING RELATED SAFETY PROBLEMS [PRUEFSTAENDE FUER FESTSTOFRAKETEN UND DAMIT ZUSAMMENHAENGENDE SICHERHEITSFRAGEN]
W. Diepold *In* WGLR Proc. of the 7th WGLR Meeting on Rocket Technol. Dec. 1968 p 11–22 refs In GERMAN (See N70-29151 14-11)
Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 32, 34 DM

The test stand, used for testing 10-15 kg of solid rocket propellant is described, together with the safeguards employed against the possibility of the propellants exploding. ESRO

N70-29154# Gesellschaft zur Verwertung Chemischer Erzeugnisse m.b.H., Liebenau (West Germany).

DESCRIPTION OF THE ROCKET TEST STANDS OF VERWERTECHEMIE AT LIEBENAU [DIE RAKETEN-PRUEFSTAENDE DER VERWERTCHEMIE IN LIEBENAU]

H. Penner *In* WGLR Proc. of the 7th WGLR Meeting on Rocket Technol. Dec. 1968 p 23-29 In GERMAN (See N70-29151 14-11)

Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 32, 34 DM

A description is given of the construction principles of a rocket test stand, together with the safety measures relating to exploding propellants and the environmental protection against the exhaust gases. ESRO

N70-29155# Goelkow G.m.b.H., Ottobrunn bei Muenchen (West Germany).

USE OF HIGH ENERGY PROPELLANTS AT BOELKOW LIQUID ROCKET PROPELLANT TEST STANDS [DAS ARBEITEN MIT HOCHENERGETISCHEN TREIBSTOFFEN AUF DEN VERSUCHSANLAGEN FUER FLUESSIGKEITSRAKETENTRIEBWERKE DER FIRMA BOELKOW IN OTTOBRUNN]

M. Mueller *In* WGLR Proc. of the 7th WGLR Meeting on Rocket Technol. Dec. 1968 p 31-56 In GERMAN (See N70-29151 14-11)

Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 32, 34 DM

High energy liquid rocket propellants have been developed and tested for several years. Oxygen, hydrogen, and fluorine liquid propellant were tested and special attention was given to procurement, storage, and transport to the propellant stands. The necessary installations for neutralizing the exhaust gases of fluroine are described and the main data on recently developed propulsion systems are also given. Author (ESRO)

N70-29156# Deutsche Versuchsanstalt fuer Luft- und Raumfahrt, Lampoldshausen (West Germany).

THERMODYNAMIC CONCEPTION AND OPERATING RANGE OF THE ALTITUDE TEST STANDS OF THE DVL AT LAMPOLDSHAUSEN [THERMODYNAMISCHE KONZEPTION UND BETRIEBSBEREICH DER HOEHENPRUEFSTAENDE DER DVL IN LAMPOLDSHAUSEN]

H. Barth *In* WGLR Proc. of the 7th WGLR Meeting on Rocket Technol. Dec. 1968 p 57-89 ref In GERMAN (See N70-29151 14-11)

Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 32, 34 DM

After an introduction to the operating methods a description is given of the thermodynamic concepts involved in the building of the altitude test stand for chemical rocket propellants. An estimation of the operating range of the test stand is given. Experience shows that the simulated altitude exceeds the altitude as stipulated by ELDO by approximately 10 per cent. ESRO

N70-29157# Deutsche Versuchsanstalt fuer Luft- und Raumfahrt, Lampoldshausen (West Germany). Inst. fuer Chemische Raketenantriebe.

OPERATIONS AND SAFETY PRECAUTIONS AT THE ALTITUDE ROCKET TEST STANDS OF THE DVL AT LAMPOLDSHAUSEN [BETRIEB DER HOEHENPRUEFSTAENDE DER DVL IN LAMPOLDSHAUSEN UND DIE GETROFFENEN SICHERHEITSMASSNAHMEN]

J. Fabian *In* WGLR Proc. of the 7th WGLR Meeting on Rocket Technol. Dec. 1968 p 91-119 In GERMAN (See N70-29151 14-11)

Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 32, 34 DM

A description is given of the altitude rocket test stand in the light of experience gained from operation between April 1964 and November 1966. The geographical siting, design, operational results, and safety precautions taken are among the aspects covered. ESRO

N70-29158# Boelkow G.m.b.H., Ottobrunn bei Muenchen (West Germany).

REPORT ON WORK CARRIED OUT AT THE ELDO-A ROCKET TEST STANDS AT LAMPOLDSHAUSEN WITH SPECIAL REGARD TO MEASURING AND CONTROL EQUIPMENT [MITTEILUNGEN UEBER ARBEITEN AUF DEN RAKETENPRUEFSTAENDEN FUER ELDO-A IN LAMPOLDSHAUSEN UNTER BESONDERER BERUECKSICHTIGUNG DER ZUGEHOERIGEN MESS- UND STEUERANLAGEN]

W. Baum *In* WGLR Proc. of the 7th WGLR Meeting on Rocket Technol. Dec. 1968 p 121-134 In GERMAN (See N70-29151 14-11)

Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 32, 34 DM

A short description is given of the developmental work carried out at the test stand. In particular, the measuring and control equipment of the test stand, as well as the special experience gained from developmental tests with propulsion systems for the ELDO-A launch vehicle, are discussed. Finally the safety precautions taken when working with the propellants AZ50 and N2O4 are mentioned. ESRO

N70-29159# Entwicklungsring Nord, Bremen (West Germany). Versuchsfeld Trauen.

LAYOUT, OPERATION AND RESULTS OF THE ELDO-A ROCKET TEST STAND AT TRAUEN [AUSLEGUNG, BETRIEB UND ERGEBNISSE DER RAKETENPRUEFSTANDSANLAGEN FUER DAS PROJEKT ELDO-A IN TRAUEN]

H. Lang *In* WGLR Proc. of the 7th WGLR Meeting on Rocket Technol. Dec. 1968 p 135-142 In GERMAN (See N70-29151 14-11)

Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 32, 34 DM

The test stand is used to test the third stage of the ELDO-A launch vehicle under normal environmental conditions. The layout, operation, and test results of the stand are described. ESRO

N70-29160# Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Trauen (West Germany). Inst. fuer Stramlantriebe.

REQUIREMENTS OF ROCKET TEST STANDS FOR RESEARCH PROBLEMS BASED ON EXPERIENCE GAINED AT THE DFL TEST STAND AT TRAUEN [ANFORDERUNGEN AN RAKETENPRUEFSTAENDE FUER AUFGABEN DER FORSCHUNG, DISKUTIERT AM BEISPIEL DER DFL-ANLAGEN IN TRAUEN]

A. Langemeyer *In* WGLR Proc. of the 7th WGLR Meeting on Rocket Technol. Dec. 1968 p 143-157 In GERMAN (See N70-29151 14-11)

Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 32, 34 DM

The rocket test stand was constructed especially for research purposes. The special requirements of rocket test stands for research into laboratory techniques, as well as pressure and combustion are given. ESRO

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N70-27820# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE SHAPE OF THE FLOW SEPARATION ZONE INDUCED BY THE INCIDENCE OF A THREE-DIMENSIONAL SHOCK WAVE ON A PLATE WITH TURBULENT BOUNDARY LAYER

Yu. A. Panov 3 Nov. 1969 17 p refs Transl. into ENGLISH from Moscow Univ., Vestn. Ser. 1, Mat., Mekh. (Moscow), no. 1, 1969 p 59 - 65

(AD-702287; FTD-MT-24-277-69) Avail: CFSTI CSCL 20/4

The results of an experimental investigation of the structure of a separated flow on a flat plate in the region of a three-dimensional shock wave - turbulent boundary layer interaction are presented for free-stream Mach number equal to 3 and Reynolds number Re equals 1.8 x 10(superscript 7). The aim of the investigation is to clarify the general principles governing three-dimensional separated flows induced by the intersection of shock waves formed by obstacles on the body surface with the boundary layer, and to supplement the scarce data available up to now. A schematic presentation of the flow pattern is given. The relationship between the characteristic geometric dimensions of the separation zone and the intensity of the incident shock wave is studied. A comparison is made between two- and three-dimensional cases. Author (TAB)

N70-27829# Aerospace Corp., San Bernardino, Calif. Technology Div.

ANALYTICAL DEFINITION OF THE CORNELL WAVE SUPERHEATER FLOW FIELD ENVIRONMENT Technical Report, May - Aug. 1969

Peter G. Crowell 27 Feb. 1970 49 p refs

(Contract F04701-69-C-0066)

(AD-702434; TR-0066(S5816-36)-2; SAMSO-TR-70-63) Avail: CFSTI CSCL 14/2

The method of characteristics has been used to define the flow fields commonly used at the Cornell Wave Superheater for nosetip ablation testing. The flow field properties were computed for the exhaust plumes produced by both the free jet and collector modes of operation. Both perfect gas and equilibrium air calculations were performed. The effect of different initial conditions at the collector exit plane, upon the flow field properties, was examined and the propagation of a possible collector shock wave out into the plume flow field was computed. Excellent agreement was obtained between the collector flow field calculations and the available rake data. The free jet flow field was simulated with an asymmetric, two-dimensional, characteristics calculation. The computed pitot pressure was in qualitative agreement with the free jet rake data. Author (TAB)

N70-27871# Catholic Univ. of America, Washington, D.C. Inst. of Ocean Science and Engineering.

DYNAMICAL STABILITY OF A TOWED THIN FLEXIBLE CYLINDER

Haven-Ping Pao Dec. 1969 39 p refs

(Contract N00014-68-A-0506)

(AD-700932; Rept-69-11) Avail: CFSTI CSCL 20/4

The stability and dynamics of a slender cylinder towed in a viscous stream are examined. The cylinder is clamped at one end and free at the other. Stability conditions and modal shapes are found based on solutions to linearized equations resulting from small deflection assumptions. Particular attention is focused on the conditions of stability when the length/diameter ratio becomes large. It is found that the stability of a slender cylinder is virtually controlled by the tail portion of the cylinder which is about 25 diameters from the free end. Some experimental observations conducted in a towing tank are in general agreement with theory. Author (TAB)

N70-27940# Massachusetts Inst. of Tech., Cambridge. Engineering Projects Lab.

AN EXPERIMENTAL AND THEORETICAL STUDY OF DENSITY-WAVE OSCILLATIONS IN TWO PHASE FLOW Topical Report, Jun. - Dec. 1969

George Yadigaroglu and Arthur E. Bergles Dec. 1969 256 p

(Contract Nonr-3963(15))

(AD-702069; DSR-74629-3) Avail: CFSTI CSCL 20/4

A theoretical and experimental investigation of fundamental aspects of density-wave oscillations was undertaken. The experimental Freon-113 loop was operated at atmospheric pressure level with constant pressure drop across a single test channel. A wide range of inlet temperatures, flows and heat inputs was covered. The regions of unstable operation of the channel were mapped for both uniform and cosine heat flux distributions. The effect of the cosine distribution was stabilizing. The period of the oscillations was approximately equal to twice the transit time, defined as the sum of one half the residence time of a fluid particle in the single-phase region plus the vapor transit time in the two-phase region. At high subcoolings and low power levels unexpected higher-order oscillations were detected. Analytically the stability of the channel is investigated by oscillating the inlet flow. The theoretical procedures used for predicting the steady-state condition in the boiling channel were tested by extensive pressure drop measurements. The predictions of the stability model are compared to the experimental observations. Author (TAB)

N70-27983*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECT OF OUTLET BAFFLING ON LIQUID RESIDUALS FOR OUTFLOW FROM CYLINDERS IN WEIGHTLESSNESS

Steven G. Berenyi Washington May 1970 13 p refs

(NASA-TM-X-2018; E-5521) Avail: CFSTI CSCL 20D

An experimental investigation was conducted in a weightless environment to study the effect of outlet baffles in reducing liquid residuals after draining from cylindrical tanks. Residuals were compared for two baffle positions and four baffle configurations. Comparisons are made with previous results obtained for unbaffled tanks. The results showed that the liquid residual remaining in a tank after draining in weightlessness can be reduced to about 60 percent of the unbaffled case for some of the systems tested. Also discussed are the pressure losses associated with each baffle configuration. Author

N70-28000# Naval Ship Research and Development Center, Washington, D.C.

AN APPLICATION OF LINEARIZED THEORY TO WATER ENTRY AND WATER EXIT PROBLEMS. PART 1: WITH GRAVITY EFFECT

B. Yim Nov. 1969 22 p refs

(AD-700911; NSRDC-3041) Avail: CFSTI CSCL 20/4

A method is given for obtaining the flow field under the free surface disturbed by either an impinging or an exiting thin foil of arbitrary shape; the method includes gravity effect but not the similarity rule. A time-dependent Green function is utilized for the solution. As an example, the Froude number effect of a thin two-dimensional wedge entering the water is analyzed, and the pressure distributions on the wedge, the drag, and the wave height at the wedge are given. The physical quantities at Froude Number 3 are shown to be very close to the case of infinite Froude number. Author (TAB)

N70-28030# Pennsylvania State Univ., University Park. Ordnance Research Lab.
THE INFLUENCE OF POROSITY AND CONTACT ANGLE ON INCIPIENT AND DESINENT CAVITATION
Surender Kumar Gupta (Ph.D. Thesis) 15 Dec. 1969 106 p refs
(Contract NOw-65-0123-D)
(AD-700919; TM-508-2451-06) Avail: CFSTI CSCL 20/4

The investigation was primarily devoted to the determination of the effect of porosity and contact angle on incipient and desinent cavitation. The primary test models were 1/4-inch diameter hemispherical-nosed bodies made of teflon, rubber, polyethylene, stainless steel and glass. The test results imply that the hydrophobic surfaces, i.e., teflon and polyethylene models, contribute surface nuclei to the inception process provided that the surface nuclei are in a normal condition, i.e., no effort has been made to minimize surface nuclei by extreme pressurization, etc. On the other hand, the hydrophilic hemispherical models made of glass and stainless steel seem to show no contribution of surface nuclei to the onset of cavitation and may depend entirely on the stream nuclei for cavitation. However, the rubber model which was hydrophilic in nature was not consistent with the other hydrophilic models.
Author (TAB)

N70-28031# Colorado State Univ., Fort Collins. Fluid Dynamics and Diffusion Lab.
FLOW SEPARATION IN TIME VARYING FLOW
Fang-Kuo Chou and V. A. Sandborn Dec. 1969 66 p refs
(Contract N00014-68-A-0493-0001; Proj. Themis)
(AD-700926; CER69-70FkC-VAS23; Themis-CER-TR-6) Avail: CFSTI CSCL 20/4

An exact solution of time varying pipe flow with a fluctuating velocity superimposed on the mean flow is analyzed. The velocity profiles, together with the profile parameters at separation, are computed from a computer program. The results are compared with the model for relaxed (steady) and unrelaxed (unsteady) separation criteria proposed by V. A. Sandborn and S. J. Kline. For very low frequencies, the correlation curves appear to have a reasonable agreement with the proposed relaxed separation criterion. For high frequencies, the correlation curves were found to fall approximately on the unrelaxed separation criterion. This result demonstrates further that adjustment time is an important factor for separation to be relaxed or unrelaxed, a new concept proposed by Sandborn. In addition, J. T. Stuarts solution for the flow along an infinite flat plate with normal suction and periodic external velocity is further analyzed. The results again prove to agree with the proposed new concept.
Author (TAB)

N70-28044# Sandia Corp., Albuquerque, N. Mex.
ONE-DIMENSION LAGRANGIAN HYDRODYNAMICS AND THE IDLH HYDROCODE
Darrell Lee Hicks Dec. 1969 68 p refs
(SC-RR-69-728) Avail: CFSTI

One Dimension Lagrangian Hydrodynamics (IDLH) fundamentals were investigated from the computation point of view and a IDLH computer hydrocode was constructed and tested. The IDLH scheme is similar to the ingenious method developed in the U.S.S.R. The test results indicate that the Godunov method is more accurate than the artificial viscosity methods which are generally used in the U.S. Although the code is one dimension Lagrangian, the scheme can easily be altered to Eulerian and extended to 2 and 3 Euclidean dimensions. The scheme also appears to be extendable to any continuum mechanics problem in any geometry. The problems of artificial viscosity, nonlinear stability analysis, compactness, convergence, and existence are also discussed.
Author (NSA)

N70-28150# Naval Postgraduate School, Monterey, Calif.
ESTABLISHMENT OF BLASIUS FLOW IN AN OPEN CHANNEL
William Michael Slack Apr. 1969 36 p refs
(AD-701673) Avail: CFSTI CSCL 20/4

The objective of the thesis was to simulate steady, uniform, laminar flow over a plane surface with zero pressure gradient. Design parameters and requirements for the flow field and construction of the free surface water channel are discussed. Data acquisition was accomplished by means of the hydrogen bubble technique; and, once acquired was used to obtain a normalized velocity profile. An uncertainty analysis on the acquisition method and a comparison of the experimental results with the solution obtained by Blasius are presented.
Author (TAB)

N70-28278# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A SIMPLE METHOD OF CALCULATING A LAVAL NOZZLE
A. Sh. Dorfman 11 Dec. 1969 11 p refs Transl. into ENGLISH from Akad. Nauk UKR. SSR Inst. Teploenerg. Sb. Tr. (Kiev), v. 14, 1958 p 26-31
(AD-702148; FTD-HT-23-414-69) Avail: CFSTI CSCL 20/4

The paper presents a simple method of constructing a Laval nozzle to assure a plane-parallel supersonic flow. A simplified method is given for calculating the initial velocity distribution of the sonic and supersonic portions of the nozzle and formulas are introduced together with curve equations for calculating the compensating section of the nozzle wall. An example of the nozzle construction formulas is given in order of their calculation.
Author (TAB)

N70-28307 Drexel Inst. of Tech., Philadelphia, Pa.
CONTINUOUS WITHDRAWAL OF NEWTONIAN LIQUID FILMS ON VERTICAL PLATES
Anthony Joseph Soroka (Ph.D. Thesis) 1969 242 p
Avail: Univ. Microfilms: HC $11.05/Microfilm $3.15 Order No. 69-20140

When an object is vertically and continuously withdrawn from a liquid bath, some of the liquid adheres to the object in the form of a film. At some point above the liquid level the film thickness takes on a constant value. An analytical expression is developed theoretically to predict this constant film thickness up to high withdrawal speeds. The development is limited to the case where the objects withdrawn are flat plates and the liquids are Newtonian. The Gravity Corrected Theory is extended by relaxing the assumption of negligible inertial force. Using the Oseen approximation, an inertial theory of withdrawal is derived in analytical form. Entrainment was measured to test the new theory using continuous withdrawal of an endless 6.2 cm wide belt through a Van Rossum bath. Newtonian oils with viscosities of 0.5, 2.5 and 19 poise were studied for withdrawal speeds from 5 to 80 cm/sec.
Dissert. Abstr.

N70-28326# Ohio State Univ., Aeronautical and Astronautical Research Lab.
AN INVESTIGATION OF PLANAR FREE JETS Interim Technical Report
Jay W. Bittner and Gerald M. Gregorek Nov. 1969 41 p refs
(Contract F33615-68-C-1220)
(AD-700778; ARL-69-0185; ITR-2578-2) Avail: CFSTI CSCL 20/4

Suggested use of highly underexpanded free jets for hypersonic low density facilities has led to an analytic and experimental study of planar free jets. Tests with sonic slot nozzles showed strong oblique shocks emanating from the ends. The shocks dominated the expansion process, and terminated the isentropic flow far upstream of a theoretical location for a normal shock, even for a slot of length-to-width ratio of 200. Side plates reduced these end effects, increasing the isentropic region by moving the shock system downstream. The two-dimensional method of characteristics was employed to study planar expansions from slot nozzles of three different exit Mach numbers operating at different pressure ratios. Surface pressures taken from the side plates agree well with

predictions from the characteristics theory, until the isentropic expansion is ended by shocks caused by boundary layer separation from the side plates. Author (TAB)

N70-28332 Ohio State Univ., Columbus.
TURBULENCE AND MIXING IN A CONTINUOUS FLOW STIRRED TANK
M. Anandha Rao (Ph.D. Thesis) 1969 170 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 69-22192

Turbulence and mixing in the paddle impeller stream of a continuous flow, stirred tank have been unknown quantities. The turbulence parameters were obtained in the direction of the velocity vectors by means of a hot-film probe. The directions of the mean velocity vectors were first determined with a three-dimensional pitot tube. The average velocities obtained with the pitot tube were much higher than with the hot-film anemometer due to the high intensity and large scale turbulence in the flow field. The turbulence field was anisotropic and intermittent, blades. latter being caused by a highly turbulent and randomly moving jet generated by the impeller blades Autocorrelations and one-dimensional spectra of the velocity fluctuations were obtained at various positions in the tank. These revealed the presence of periodic velocities close to the impeller, generated by the rotating impeller blades. Dissert. Abstr.

N70-28445# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE GAS DYNAMICS OF TWO-PHASE MEDIA
M. E. Deich et al 13 Jan. 1970 502 p refs Transl. into ENGLISH of the book "Gazodinamika Dvukhfaznykh Sred" Moscow Energiya, 1968 423 p
(AD-701975; FTD-HT-23-188-69) Avail: CFSTI CSCL 20/4

The book is devoted to problems in the motion of two-phase media (fluids) of high velocity relevent to the development of fixed and transportational energy, atomic power stations, and other areas of physics and thermal energy. It explains the theoretical basis of two-phase medium mechanics, the computational methods, the solution of condensation problems in high-velocity flows and of the velocity of sound in the two-phase medium. In addition, subsonic and ultrasonic currents of water vapor in a quasi-unidimensional statement of the problem are considered. The book deals with applied problems of two-phase medium motion in nozzles, pipes, injectors, turbine gratings, and steam-operated turbine stages. Attention is given to some problems on the motion of films and methods of experimentally investigating the medium currents. Author (TAB)

N70-28494# Defense Research Board, Ottawa (Ontario). Scientific Information Service.
THE RAYLEIGH EQUATION OF GAS BUBBLE GROWTH UNDER CONDITIONS OF FINITE LIQUID VOLUME
Ye. D. Kurtzman Dec. 1969 4 p refs Transl. into ENGLISH from Inzh.-Fiz. Zh. (Moscow), v. 14, no. 1, 1968 p 165–167
(AD-699737; T-531-R) Avail: CFSTI CSCL 20/4

The growth equation is given for an immobile spherical gas bubble in a finite spherical volume of liquid, a case to which the well-known Rayleigh equation is a zeroth approximation; the computer solutions of the new equation and of the Rayleigh equation are formulated. Author (TAB)

N70-28648*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A SURVEY OF THE TRANSPORT PROPERTIES OF HELIUM AT HIGH MACH NUMBER WIND-TUNNEL CONDITIONS
Del V. Maddalon and Willis E. Jackson Washington Jun. 1970 28 p refs
(NASA-TM-X-2020; L-7004) Avail: CFSTI CSCL 20D

Important experimental data are tabulated and correlation techniques examined. Theoretical calculations of quantum-mechanical effects on viscosity and thermal conductivity agree with the available low-temperature data (< 15 K). It is pointed out that Reynolds number is often calculated by using Keesom's power-law relation for viscosity and that this procedure results in an error of about 54 percent at a typical helium-tunnel operating condition (Mach number of about 20 and static temperature of about 2.25 K). Equations for viscosity are presented, based on the quantum calculations, and this method eliminates such errors. Equations for thermal conductivity are also given. Author

N70-28868*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
EFFECT OF CHAMBER-TO-NOZZLE HEAT EXCHANGE ON FROZEN AND EQUILIBRIUM FLOWS IN DE LAVAL NOZZLES
Raymond Le Roy Nieder (M.S. Thesis-Texas Univ., Austin) Apr. 1970 124 p refs
(NASA-TM-X-58043) Avail: CFSTI CSCL 20D

A rocket thrust chamber assembly was analyzed to determine the exit conditions that result when heat is withdrawn from the combustion chamber and simultaneously added to the gas flow in the nozzle. The analysis was performed for three cases. The first case considers the flow of an inert gas in the nozzle, the second considers the equilibrium flow of a dissociating diatomic gas, and the third case considers the addition of heat to the dissociating diatomic gas flow in the nozzle without the removal of heat from the combustion chamber. Results of the inert gas analysis show that transferring heat from the combustion chamber to the nozzle causes a decrease in both exit velocity and specific impulse but results in an increase in exit pressure and exit temperature. The dissociating diatomic gas behaves in a manner similar to the inert gas, but the magnitude of the decrease is not as great. This damping effect is caused by dissociation of the diatomic gas. When heat is applied to the nozzle, but not removed from the chamber, the dissociating diatomic gas shows an increase in exit velocity, exit pressure, exit temperature, and specific impulse. Author

N70-28746# Virginia Polytechnic Inst., Blacksburg. Dept. of Engineering Mechanics.
SURFACE CONDITIONS IN SLIP-FLOW WITH MASS TRANSFER
R. E. Whitehead and R. T. Davis Dec. 1969 20 p refs Sponsored by AEC Prepared for Sandia Corp., Albuquerque, N.Mex.
(SC-CR-69-3289; VPI-E-69-11) Avail: CFSTI

The slip-flow boundary conditions for low Reynolds number flow with mass transport are derived using kinetic theory for a slightly non-Maxwellian velocity distribution. The boundary conditions are expanded and simplified for both small and large injection velocities. The continuum stress and heat transfer conditions at a surface in slip-flow with mass injection are found and written in terms of the slip-flow boundary conditions. The boundary conditions for second-order boundary-layer theory are found for the injection case using the expressions mentioned above. The surface conditions may also be used for the viscous shock-layer problem with mass injection. Author

N70-28850# National Lucht-en Ruimtevaartlaboratorium, Amsterdam (Netherlands).
AN APPLICATION OF THE N-STRIP METHOD OF INTEGRAL RELATIONS FOR ANALYZING THE FLOW AROUND A CIRCULAR CONE
P. J. Zandbergen and H. I. Baurdoux 1969 52 p refs
(NLR-TR-69020-U) Avail: CFSTI

The solution of sets of non-linear partial differential equations using the method of integral relations is considered. Emphasis is laid on the derivation of a general N-strip approximation algorithm. In order to check the applicability of this algorithm a program has

been written to obtain the solution of the flow field around a circular cone at incidence in supersonic flow. Using the method of Stone, the angle of attack has been taken into account up to the second order. Thus a comparison can be made with the results given by Kopal. The results show that the N-strip algorithm in the case studied is a very attractive method which leads directly to results of high accuracy. Author (ESRO)

N70-28883# General Electric Co., Philadelphia, Pa. Re-Entry and Environmental Systems Div.
THE IONIZED STAGNATION REGION FLOW AT LOW REYNOLDS NUMBER
H. Lew Nov. 1969 40 p refs
(DOC-70SD224) Avail: CFSTI

A study is made in this report of the low Reynolds viscous flow including the merged layer region for a chemically reacting gas as dissociated and ionized air species at the stagnation region of blunt bodies. Use of a two layer model has allowed the inclusion of the effects of heat transfer, shear stress, and heat conduction at the shock. In particular, the electron density in this nonequilibrium regime has been obtained. Results incidate that the production of electrons at the low density regime is still appreciable. Comparison with experimental data tend to indicate that the overall combined scheme of chemical rate constants, species transport and diffusion properties is a reasonable one. Author

N70-28937# Aeronautical Research Council (Gt. Brit.).
BOUNDARY-LAYER INTERACTION EFFECTS IN INTAKES WITH PARTICULAR REFERENCE TO THOSE DESIGNED FOR DUAL SUBSONIC AND SUPERSONIC PERFORMANCE
J. Seddon 1970 25 p refs Supersedes RAE-TR-66099; ARC-28368
(ARC-R/M-3565; RAE-TR-66099; ARC-28368) Copyright. Avail: CFSTI; HMSO: 13s; bis $2.80

The nature of flow intakes with external boundary layer, at subsonic and supersonic speeds, is described. On the basis of a systematic series of wind-tunnel tests, a quantitative assessment is made of the loss or pressure recovery due to interaction between the boundary layer and the preentry pressure gradient. Author (ESRO)

N70-29173# Fraunhofer Institut, Freiburg (West Germany).
A PROGRAM FOR PLOTTING WAVE DIAGRAMS FOR THE SIMPLE MEMBRANE SHOCK TUBE [EIN PROGRAMM ZUM ERSTEELEN VON WELLENDIAGRAMMEN FUER DAS EINFACHE MEMBRANSTOSSROHR]
G. Guerke and G. Schwarzkopf Dec. 1969 76 p refs In GERMAN
(Rept-12/69) Avail: CFSTI

An ALGOL computer program is described, which computes wave diagrams for membrane shock tubes of constant cross section. Tables for the preparation of wave diagrams for some gas combinations (air/air, He/air, H2/air) are given. Graphs for the rapid production of wave diagrams for shock tubes employing air against air of the same temperature are presented. The method is demonstrated using examples. ESRO

N70-29174# Fraunhofer Institut, Freiburg (West Germany).
CELLULAR STRUCTURE OF DETONATION WAVES [ZELLENSTRUKTUR VON DETONATIONSWELLEN]
F. Schultz-Grunow and W. G. Struck Jul. 1969 43 p refs In GERMAN
(Rept-5/69) Avail: CFSTI

In view of the cellular structure of detonation waves which was demonstrated by remarkably regular soot patterns, circular and spherical detonation waves were investigated with soot and several optical methods. A new concept of the detonation mechanism was derived, which is confirmed by previous observations. ESRO

N70-29183# Fraunhofer Institut, Freiburg (West Germany).
STARTING PROCESSES OF A PLANE REFLECTION NOZZLE [VORGAENGE BEIM START EINER EBENEN REFLEXIONSDUESE]
H.-O. Amann (Ph.D. Thesis—Karlsruhe Univ.) 1968 123 p refs In GERMAN
(Rept-9/68) Avail: CFSTI

The nonstationary starting processes of a plane reflection nozzle, due to a flat shock wave, were investigated. The primary reflected and secondary shocks, along with the secondary contact surface, separation front and separation point of the starting processes were obtained from shadowgraphs. The effect of varying the nozzle opening angle, inlet height and inlet radius are shown on photographs and path-time diagrams. The density variations were determined from interference photographs at different times during the starting process. Simplified one-dimensional models (steady state models) are also discussed. ESRO

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N70-27817# Road Research Lab., Crowthorne (England).
AN EXAMINATION OF METHODS OF DETERMINING THE SPECIFIC GRAVITY OF SOILS
J. V. Krawezyk 1969 26 p
(PB-187572; RRL-LR272) Avail: CFSTI CSCL 13B

The results are described of an investigation made to find methods for the determination of the specific gravity of soils that are less subject to error than those now used. The report shows that the present method for coarse-grained soils can be made more reliable and used for all types of soils if the air is removed from the soil by a shaking technique in place of removal under vacuum. The use of a Loebell air pycnometer is described and it is shown that this apparatus can be adapted for the rapid determination of the specific gravity of soils. The time taken is less than 15 minutes and the accuracy is sufficient for most purposes. Author

N70-27823# Hawaii Inst. of Geophysics, Honolulu.
A REGIONAL ANALYSIS OF CRUSTAL STRUCTURE IN NORTH AMERICA, PART 1: A STUDY OF THE PROBLEMS ASSOCIATED WITH THE PREDICTION OF GRAVITY IN EUROPE Final Report
George P. Woollard 26 Jun. 1969 230 p refs
(Contract F23601-68-C-0186)
(AD-701388; HIG-69-12) Avail: CFSTI CSCL 8/7

The report is contained in two parts. Part I is an analysis of present gravity prediction procedures in the light of geophysical data concerning the crust and upper mantle. The assumptions on which these procedures are based (areas in isostatic equilibrium, relationship between Bouguer values and elevation, secondary control of Bouguer values, effects of near surface changes in geology) and their effects are discussed. Part II analyses the problems of predicting gravity in Europe. The geophysical factors related to these problems (a continental block bounded by deep water, intense tectonic deformation, acid and basic intrusives, lack of seismic measurements, glacial loading) are reviewed and the results tabulated. Author (TAB)

N70-27889# California Inst. of Tech., Pasadena. Seismological Lab.
EVALUATION OF EQUATION OF STATE DATA Final Report, 1 Jun. 1968 - 31 Aug. 1969

Thomas J. Ahrens and Don L. Anderson Jan. 1970 61 p refs
(Contract DASA01-68-C-0069)
(AD-700916; DASA-2359) Avail: CFSTI CSCL 8/7

Equations of state for earth materials are necessary for the calculation of intense stress-wave propagation and seismic coupling resulting from explosions or impacts on or within the earths crust. Because of the wide range of dynamic pressures which are induced within the vicinity of a nuclear explosion, the equations of state which are of interest will describe the response of a medium over a range of conditions from thousands of kilobars and tens of thousands of degrees down to a fraction of a bar and ambient temperature. The present program has been concerned with the analysis of a large body of published data obtained by shock-wave techniques which describe the dynamic behavior of a number of earth materials below 2 megabars. Most of these data are expressed in terms of Hugoniot curves, however the authors have used additional data such as composition of the rocks or minerals involved, thermodynamic properties, and attempted to examine the systematics of the equations of state of these materials. The authors have also reduced the shock-wave data to pressure-volume-temperature variables. Author (TAB)

N70-27881# Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.
OCEANIC MIXING Technical Report
Akira Okubo Jan. 1970 153 p refs
(Contract Nonr-4010(11); AT(30-1)-3109)
(AD-702038; TR-62) Avail: CFSTI CSCL 8/3

The present knowledge of oceanic mixing is summarized. Two processes, advection and diffusion, which contribute substantially to oceanic mixing and their interaction are recognized in the mechanism of mixing. Environmental features of the sea in relation to advective and diffusive processes are also described. Author (TAB)

N70-27896# Uppsala Univ. (Sweden). Geodetic Inst.
BOUGUER GRAVITY MAP OF THE UPPSALA REGION
Erik Tengstrom 1969 7 p
(Contract AF 61(052)-766)
(AD-702483; AFCRL-70-0077(4)) Avail: CFSTI CSCL 8/5

The report contains a Bouguer gravity map of the Uppsala region and an example of model computations on one of the anomalies. The measurements have been performed with the Worden gravity meter nr 681 by students from the Institute of Geodesy, Hallby, Uppsala. Author (TAB)

N70-27958# Radio Corp. of America, Princeton, N.J. Astro Electronics Div.
PASSIVE MICROWAVE MEASUREMENTS OF SEA SURFACE TEMPERATURE Final Report
Don G. Shipley and Kenneth J. Torok Dec. 1969 408 p
(Contract N00014-69-C-0245)
(AD-702044; AED-R-3525) Avail: CFSTI CSCL 8/10

RCA Astro-Electronics conducted a field experiment to verify a theoretical approach toward remote sensing of sea surface temperature using passive microwave radiation. There is a correspondence between the radiometric temperature of the sea and its thermometric temperature. This correspondence is influenced by the horizontal and vertical emissivity, the incidence angle at which the radiometric measurement is being made, contaminants on the water surface, and by the sea surface roughness. The experiment addressed itself to two basic questions: (1) Can one measure the vertically and/or horizontally polarized microwave radiometric emissions from the sea water and obtain an accurate measure of the thermometric temperature. (2) Can one also make a determination of sea state from such measurements. The radiometric measurements were made from North Island of the Chesapeake Bay Bridge and Tunnel District. The bulk of the microwave measurements were made at a frequency of 16.5 GHz. Author (TAB)

N70-27971*# GCA Technology Div., GCA Corp., Bedford, Mass.
RANGE AND STRUCTURE OF AMBIENT DENSITY FROM 30 TO 120 km ALTITUDE
Raymond A. Minzner, S. Mello, and Paul Morgenstern May 1970 398 p refs
(Contract NAS8-20098)
(NASA-CR-61322) Avail: CFSTI CSCL 04A

CONTENTS:

1. ANALYSIS OF STATISTICAL MODELS R. A. Minzner and P. Morgenstern 271 p refs (See N70-27972 14-13)

2. DENSITY DEVIATIONS FROM THE US STANDARD ATMOSPHERE 1962 AND THE PATRICK REFERENCE ATMOSPHERE 1963 R. A. Minzner and S. Mello 126 p refs (See N70-27973 14-13)

N70-27972*# GCA Technology Div., GCA Corp., Bedford, Mass.
ANALYSIS OF STATISTICAL MODELS
R. A. Minzner and P. Morgenstern *In its* Range and Struct. of Ambient Density from 30 to 120 km Altitude May 1970 271 p refs (See N70-27971 14-13)
(GCA-TR-68-15-N) Avail: CFSTI CSCL 04A

Altitude profiles of atmospheric temperature, pressure and density obtained from 437 rocket soundings for various portions of the altitude interval 30 to 120 km were gathered for various statistical investigations. The soundings were sorted into homogeneous cells of a three-dimensional array defined by specific diurnal, seasonal, and latitudinal categories. Six diurnal categories are defined in terms of solar zenith angles and earth shadow heights. Eight seasonal categories are defined in terms of astronomical as well as continental climatological considerations. Six latitude bands are defined in 15-degree increments with seasonal inversions to permit combining of southern and northern latitude regions. The quasi-homogeneous stratification of data has permitted the determination of the independent influence of each of the three mentioned variables on certain atmospheric properties. Two particular investigations involve the validity of statistical versions of the gas law and of hydrostatic equations (as applied to the generation of atmospheric models) with data of various degrees of homogeneity. Author

N70-27973*# GCA Technology Div., GCA Corp., Bedford, Mass.
DENSITY DEVIATIONS FROM THE US STANDARD ATMOSPHERE 1962 AND THE PATRICK REFERENCE ATMOSPHERE 1963
R. A. Minzner and S. Mello *In its* Range and Struct. of Ambient Density from 30 to 120 km altitude May 1970 126 p refs (See N70-27971 14-13)
(GCA-TR-67-16-N) Avail: CFSTI CSCL 04A

This study is an attempt to improve the utility of both the U.S. Standard Atmosphere and the Patrick Reference Atmosphere by comparing these models in the altitude range of 30 to 120 km with observations over various sites at various times of the year. Comparisons are made on the basis of density data. This parameter was selected because many atmospheric-sounding techniques measure density more or less directly, and because most published sounding data include atmospheric density, even where temperature or pressure data are absent. Author

N70-28033# Uppsala Univ. (Sweden). Geodetic Inst.
SOME RESULT OF UPWARD CONTINUATION OF GRAVITY AND DEFLECTIONS BY MEANS OF THE TAYLOR SERIES METHOD IN THE WESTALP TEST AREA
Erik Tengstrom 1969 17 p
(Contract AF 61(052)-766)
(AD-702482; AFCRL-70-0077(3)) Avail: CFSTI CSCL 8/5

The report contains some results of upward continuation of gravity and deflections by means of the Taylor series method in the Westalp test area. Author (TAB)

N70-28063# Uppsala Univ., (Sweden). Geodetic Inst.
THE QUESTION OF SECULAR VARIATIONS IN THE EARTH'S GRAVITY FIELD FROM MASS DISPLACEMENTS IN THE EARTH'S DEEP INTERIOR
Andreas Vogel 1968 5 p
(Contract AF 61(052)-766)
(AD-702485; AFCRL-70-0077(6)) Avail: CFSTI CSCL 8/5

There is no doubt that gravity changes due to mass displacement close to the earths surface. There can be variations from fluctuations of the groundwater table, tectonic movements connected with landuplift or magna flow. The question, if there are variations due to mass displacements, is very much the question, where we have the origin of the lower harmonics in the earths gravity field. If their sources are zonal density anomalies in the fluid core, secular variations can be expected. The lower harmonics do not show any correlation to the distribution of continents and oceans. Consequently an anomalous density distribution must exist in parts of the earths interior which are deeper than the earths crust. The report discusses mass distributions to explain lower harmonics in the earths gravity field. Author (TAB)

N70-28111*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OBSERVATIONS OF THE SUPRATHERMAL ELECTRON FLUX AND THE ELECTRON TEMPERATURE AT HIGH LATITUDES
E. J. Maier and B. C. Narasinga Rao Mar. 1970 21 p refs Submitted for publication
(NASA-TM-X-63906; X-621-70-108) Avail: CFSTI CSCL 04A

Observations of suprathermal electrons in the energy range of 5-200 eV were obtained with retarding potential analysers on Explorer 31 in the altitude range of 1700 to 3000 km over the northern high latitudes during winter 1965-1966. It is found that there are three distinct zones consisting mainly of (i) a steady flux of photoelectrons in latitudes (ii) a high and variable flux containing precipitated particles in the auroral latitudes and (iii) a low flux over the polar region. Evidence is presented to show that the magnetic field lines are closed at least up to L = 7.7 for these particles. The boundaries of precipitation vary with local time and are somewhat different from those of the auroral oval. The ambient electron temperature appears to be dependent on the level of flux in the auroral and polar region. Author

N70-28161*# Research Triangle Inst., Durham, N.C. Engineering and Environmental Sciences Div.
APPLICATIONS OF AEROSPACE TECHNOLOGY IN AIR POLLUTION CONTROL Quarterly Progress Report, 15 Jun. - 14 Sep. 1969
14 Sep. 1969 32 p ref
(Contract NASw-1950)
(NASA-CR-110004; RTI-EU-469; QPR-1) Avail: CFSTI CSCL 04A

Evaluations of 21 computer searches of NASA's aerospace information system were completed. Also, 30 responses to problem statements were received from scientists and engineers at five NASA Field Centers. Evaluations of suggested solutions contained in the responses have begun. As a result of these activities, two transfers of technology have been accomplished and two potential technology transfers have been documented. Additionally, it is expected that the technology that has been identified will lead to solutions of approximately 10 problems presently being investigated. Results of efforts to identify aerospace technology that can be applied to solve or aid in the solution of problems in air pollution control indicate that the best approach to identifying this technology is through direct contact with engineers and scientists at NASA Field Centers. Thus, the efforts of the Research Triangle Institute Technology Application Team are being directed towards establishing improved lines of communications. Author

N70-28287*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CONFIGURATION OF THE GEOMAGNETIC TAIL DURING SUBSTORMS
D. H. Fairfield and N. F. Ness May 1970 43 p refs Submitted for publication
(NASA-TM-X-63910; X-692-7-164) Avail: CFSTI CSCL 08N

IMP 4 vector magnetic field measurements and the geomagnetic AE index are utilized in studying the configuration of the geomagnetic tail and its variations during substorms. The existence of a depressed field magnitude region corresponding to the average position of the plasma sheet is confirmed and the average solar magnetospheric component of the field is found to be northward and independent of distance from the expected position of the neutral sheet. Prior to and during the early phases of a substorm the tail field magnitude increases and the northward field component decreases as the plasma sheet becomes thin. Later in the substorm the field magnitude decreases and the northward field component increases as the tail field relaxes to a more dipolar state. The greater number of field lines crossing the neutral sheet after the substorm is consistent with an expanded plasma sheet and supports reconnection theories. Author

N70-28333# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
THE WEST GERMAN FIRST-ORDER TRIANGULATION NET AS PART OF THE EUROPEAN FIRST ORDER TRIAGULATION NET (RETrig): SUMMARY OF RESULTS OF FIRST-ORDER TRIANGULATIONS AT STATIONS OF THE WEST GERMAN FIRST-ORDER TRIANGULATION NET AND AT NEIGHBORING STATIONS [DAS WESTDEUTSCHE HAUPTDREIECKSNETZ ALS ANTEIL ZU DEN EUROPAEISCHEN HAUPTNETZTRIANGULATIONEN (RETRIG): ZUSAMMENSTELLUNG DER ERGEBNISSE DER WINKELBEOBACHTUNGEN 1.0. AUF STATIONEN DES WESTDEUTSCHEN HAUPTDREIECKSNETZES UND AUF RANDSTATIONEN]
Hans-Joachim Spiess 1969 244 p In GERMAN; ENGLISH summary Reihe B, Angew. Geodaesie, Heft Nr. 172, Teil 1
(Rept-1-Pt-1) Avail: CFSTI

The motives, purpose, method, and scope of processing the observation data for the large number of first-order triangulations within the West German First Order Triangulation Net are described. The measuring results, together with descriptions and references, are presented in tabular form for each German observation station and for some stations of neighboring states. Author

N70-28349# Federal Scientific Corp., New York.
AMPLITUDE SCINTILLATION STUDY Final Technical Report
Mark R. Weiss, Thomas W. Parsons, and Joseph H. Flink Feb. 1970 328 p
(Contract AF 30(602)-4222)
(AD-702131; FSC-F/166; RADC-TR-68-416-Vol-2) Avail: CFSTI CSCL 4/1

The presence of the atmosphere acts to degrade the transmission of optical signals. Natural turbulence in the atmosphere induces amplitude fluctuations on a propagated optical signal. The report describes an experimental program conducted to determine the characteristics of amplitude scintillation. The study was aimed at defining the degree of scintillation incurred and the associated frequency spectrum for a source emmersed in the atmosphere. Correlation studies were also undertaken to relate the scintillation characteristics to the meteorological parameters of the troposphere. Volume II reports the analysis procedures and calculations of the statistics of the experimental variables. Aperture effects and spectra shaping are analyzed and the results given. Author (TAB)

N70-28539*# Ohio State Univ., Columbus. ElectroScience Lab.
RADAR BACKSCATTERING DATA FOR SURFACES OF GEOLOGICAL INTEREST
C. H. Shultz, T. L. Oliver, and W. H. Peake 2 Dec. 1969 89 p refs
(Contract NSR-36-008-027)
(NASA-CR-110131; TR-1903-7) Avail: CFSTI CSCL 08G

This report presents measurements of the normalized backscattering cross section (per unit projected area) which have been made over the past few years on a number of surfaces of geological interest. The significance of these ground-based radar measurements is two-fold: first, they serve as a calibration for airborne radars and provide estimates of radar return for system designers; secondly, they provide measurements over well-defined, homogeneous surfaces which are accompanied by rather detailed surface descriptions. Thus they can serve as basic data for the interpretation of surface response in terms of surface parameters. Author

N70-28582*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
ETHIOPIAN RIFT AND PLATEAUS: SOME VOLCANIC PETROCHEMICAL DIFFERENCES
P. A. Mohr Mar. 1970 29 p refs
(Grant NGR-09-015-002)
(NASA-CR-110086) Avail: CFSTI CSCL 08G

The chemical data from published Ethiopian and Yemeni rock analyses and petrographic descriptions were examined and correlated. The strong suggestion of distinctive chemistry between rift and plateau volcanics in Ethiopia and Yemen is shown: for the basalts in a more under-saturated and alkali-rich character on the plateau; for the intermediates in a less saturated, less calcic, less femic, and more peralkaline character on the plateau; and for the silicics in a more over-saturated, less sodic character on the plateau. In all three classes, Na/K is higher in the rift volcanics; in the basalts and intermediates, this is largely due to potash enrichment for the plateau, but in the silicics it is due to soda enrichment. Author

N70-28583*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
NOTES ON THE AFAR TRIPLE JUNCTION
P. A. Mohr Apr. 1970 26 p refs
(Grant NGR-09-015-002)
(NASA-CR-110084) Avail: CFSTI CSCL 08G

An attempt is made to account for some unexplained geological features of Afar and the broadering plateaus. Unexplained features include the following: the fact that most of Afar lies anomalously above sea level; the existence of the sialic horsts that separate Afar from the Red Sea and Gulf of Aden; the occurrence of sialic rocks in central Afar; the parallel development of spreading axes in the Red Sea and northern Afar (inconsistent with the transforming pattern of oceanic rifts); the pattern of intense surface faulting in Afar, which is peculiarly complex and displays large fault-belt virgations, bifurcations, and even intersections; the seismicity pattern, with most energy being released along the western margin of Afar; the gravity situation, which contrasts with that of the Red Sea. These facts, together with the strong extra-rift tectonics of the Ethiopian region, suggest that simple plate theory cannot be applied to this region. This is reinforced by the impossibility of fitting Arabia and Africa to the present spreading axes of the Red Sea and Gulf of Aden. Author

N70-28662# Bureau of Mines, Washington, D.C.
SEISMIC EFFECTS ASSOCIATED WITH AN UNDERWATER EXPLOSIVE RESEARCH FACILITY
Joseph L. Condon, John N. Murphy, and David E. Fogelson Jun. 1970 24 p refs
(BMRI-7387) Avail: CFSTI

Fifteen shots of three explosives with charge weights of 0.52, 1.1, 3.1, and 5.1 kilograms were fired in a pond to study the seismic effects of detonating explosives in water. Shock pressures and bubble periods were measured with pressure transducers. Vibrations were measured on land in three orthogonal directions with particle velocity gages. Statistical tests indicated that a charge weight exponent of 0.43 best scaled the data. While shock pressures and bubble periods showed considerable differences in explosive performances, the amplitudes of ground vibrations showed less difference, and one prediction equation was therefore derived to estimate vibration amplitudes from all the explosives. Author

N70-28678# National Environmental Satellite Center, Washington, D.C.
STUDY OF THE USE OF AERIAL AND SATELLITE PHOTOGRAMMETRY FOR SURVEYS IN HYDROLOGY
Everett H. Ramey Mar. 1970 28 p refs
(ESSA-TM-NESCTM-14) Avail: CFSTI

Possible applications of photogrammetry in problems of hydrology are discussed. The critical factors in the use of satellite photographs are included. The various physical and economic factors in the use of aerial photogrammetry are analyzed in the measurement of both snow cover and snow depth. It was concluded that the required accuracy can be attained, but sometimes the cost would be prohibitive. The use of aerial photography and other related sensors to some other problems in hydrology are considered. Remote sensing from aircraft offers the hydrologist a feasible means to map some special events where detailed mapping is needed. Author

N70-28695*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE INTERNATIONAL GEOMAGNETIC REFERENCE FIELD 1965.0 IN DIPOLE COORDINATES
Gilbert D. Mead May 1970 9 p refs Submitted for publication
(NASA-TM-X-63929; X-641-70-198) Avail: CFSTI CSCL 08N

A program was written to transform the spherical harmonic coefficients of any model field into any arbitrarily-tilted coordinate system. For each value of n in the spherical harmonic expansion, the scalar potential V was calculated at $2n + 1$ randomly selected points and set equal to the potential in the tilted system. The resulting equations were solved for the $2n + 1$ unknown coefficients. The process was then repeated for the time derivatives of the coefficients representing the secular change. The resulting coefficients for the International Geomagnetic Reference Field 1965.0 are given in tabular form. Author

N70-28704# Joint Publications Research Service, Washington, D.C.
SIMULTANEOUS RADAR STUDIES OF AURORAS AT FREQUENCIES OF 75 AND 50 MHz
V. I. Dovgar 16 Apr. 1970 7 p refs Transl. into ENGLISH from Probl. Arkt. Antarkt. (USSR), no. 2, 1960 p 119–122
(JPRS-50332) Avail: CFSTI

Results of radar studies of auroras on two wavelengths, 4 and 6 meters, conducted on Dikson Island during May-July 1958 are examined. Radio observations of ionization in auroras were conducted synchronously with both radars at identical azimuthal antenna rotation rates of one rpm. The vertical plane antenna radiation pattern was constant for the six meter radar and could be smoothly changed for the four meter radar within a 4-18 deg tilt angle by a goniometer. This made it possible to study ionization distribution by elevation. These studies were part of the work program of the International Geophysical Year. A.L.

N70-28723*# Maryland Univ., College Park. Computer Science Center.
SLOPE MEASUREMENT FROM CONTOUR MAPS

Chan M. Parks, Yung H. Lee, and Bernard B. Scheps (Army Engr. Topographic Labs.) Mar. 1970 26 p refs
(Grant NGL-21-002-008; Contract AT(40-1)-3662)
(NASA-CR-110185; TR-70-109) Avail: CFSTI CSCL 08B

Two methods are described for estimating slope gradients from a digitized contour map. The first method uses amount of contour line per unit area as a slope measure, while the second computes slope by measuring distances to nearest contour lines. Both methods have been implemented in PAX 2 on the Univac 1108 computer. Author

N70-28758*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
APPLICATION OF SPACE TECHNIQUES TO SOLID-EARTH AND OCEAN PHYSICS
C. A. Lundquist May 1970 28 p refs
(Grant NGR-09-015-002)
(NASA-CR-110196; Rept-005-21) Avail: CFSTI CSCL 08F

Typical spacecraft-tracking data support simultaneous refinement of ground-station coordinates and the parameters that influence spacecraft positions. As the results from the refinement process become more detailed, especially as a consequence of improved observation techniques, dynamical phenomena within the earth become accessible to study. Both Newton and Kozai have studied the tidal mass displacements in the earth through the effects of this displacement on the orbits of satellites. Anderle and Beuglass have shown that it is possible to detect changes in position of the earth's pole from analysis of satellite orbits. Still further instrumentation advances, such as laser ranging to decimeter accuracy, very long-baseline radio interferometry, satellite-to-ocean altimeters, satellite surface-force compensation, and satellite-to-satellite tracking, allow investigation of other topics in solid-earth and ocean physics. Author

N70-28795# Weather Bureau, Silver Spring, Md. Techniques Development Lab.
TECHNIQUES FOR FORECASTING LOW WATER OCCURRENCES AT BALTIMORE AND NORFOLK
James M. Mc Clelland Mar. 1970 40 p refs
(ESSA-TM-WBTM-TDL-28) Avail: CFSTI

The development of manual techniques for forecasting low water occurrences is described. Each technique is based on a regression equation, derived by the multiple correlation screening process, which requires certain surface wind and pressure data from three Chesapeake Bay stations. The minimum and maximum time lags for each equation are 6 and 24 hours, respectively. Tests on independent data from Baltimore and Norfolk show root mean square errors of 0.6 feet and 0.4 feet, respectively. These techniques can be useful forecast aids when used under synoptic conditions favorable for low water occurrences. Author

N70-28802*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ELECTRON AND ION TEMPERATURES IN THE IONOSPHERE
A. P. Willmore Apr. 1970 120 p refs Submitted for publication
(NASA-TM-X-63933; X-621-70-145) Avail: CFSTI CSCL 04A

Many measurements of ionospheric temperature have been made during the last decade and have shown a considerable departure from thermal equilibrium there. Theoretical work has led to a general understanding of the processes which determine the energy balance of the charged particles, and most features of the experimental results are well understood in the F-region. The position in the E-region where different methods of measurement, known to agree well at greater heights, appear to disagree is less clear, whilst in the D-region no direct observations of charged particle temperature exist. The theoretical expectation here is that, on account of the rapid exchange of energy amongst the particles by collisional processes, temperature equality will prevail. Author

N70-28803# Oak Ridge National Lab., Tenn.
MASS SPECTROGRAPHIC ANALYSIS OF MINERALS AND ROCKS [MASSENSPEKTROGRAPHISCHE ANALYSE VON MINERALEN UND GESTEINEN]
H. Hintenberger [1969] 20 p Transl. into ENGLISH from Naturwissenschaften (Berlin), v. 56, no. 5, May 1969
(ORNL-TR-2220) Avail: CFSTI

Techniques of mass spectrography are described and their applications to analyses of minerals, rocks, and meteorites discussed. Examples of the mass spectra of PbS, beryl, pitchblende, and meteorites are considered. NSA

N70-28819*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
CONJUGATE PHOTOELECTRON IMPACT IONIZATION
S. D. Shawhan, L. P. Block (Royal Inst. of Tech.), and C. G. Falthammar (Royal Inst. of Tech.) Mar. 1970 43 p refs Prepared in cooperation with Royal Inst. of Tech.
(Grants NGR-001-002; NGR-16-001-043)
(NASA-CR-110013; Rept-70-17) Avail: CFSTI CSCL 04A

The exchange of photoelectrons between ionospheres in a matter of minutes rather than at the slow ambipolar speed is discussed. It is shown that the electron density may be affected by secondary processes resulting from the conjugate photoelectron flux but not by the flux itself. The flux spectrum of conjugate photoelectrons throughout the day at the solstices for minimum solar activity is calculated for 55 N. geographic latitude over Europe, using a method previously employed by Nisbet. Compared at specific solar zenith angles the computed values are in good agreement with recent satellite measurements. Approximately half of this flux is lost by Coulomb collisions along the field line path. The resulting flux arriving at the local ionosphere produces ionization by inelastic collisions in the atmosphere. This additional ionization is about 3% of the ionization from local processes at summer noon and 48% at winter noon. During winter nighttime this conjugate photoelectron ionization can be significant for several hours. Author

N70-28820*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
THE RELATION OF SOME GOEDETIC DATUMS TO A GLOBAL GEOCENTRIC REFERENCE SYSTEM
Kurt Lambeck Apr. 1970 26 p refs
(Grant NGR-09-015-002)
(NASA-CR-110014) Avail: CFSTI CSCL 08E

The relationships between three geodetic datums and the new Smithsonian Astrophysical Observatory's Standard Earth have been established through comparisons of coordinates of stations tied to both the global geocentric system and the respective datum. The datums considered are the North American Datum of 1927 (NAD), the European Datum of 1950 (EUR), and the Provisional South American Datum of 1956 (SAD). For the NAD 12 stations were used, for EUR 7 stations, and for SAD 3 stations. For several other datums one or two stations are available for determining at least the translation of the datum, but it has been found that these elements are not representative of the entire datum. Author

N70-28905# Institut Royal Meteorologique de Belgique, Brussels.
GEOPHYSICAL OBSERVATIONS [OBSERVATIONS GEOPHYSIQUES] Monthly Bulletin, Oct. 1969
1969 39 p In FRENCH and DUTCH
Avail: CFSTI

Data from the Dourbes Geophysical Observatory (Belgium) relating to geomagnetism, air radioactivity, ionospheric parameters, seismology, atmospheric electricity and cosmic rays for October 1969 are presented. ESRO

N70-28906# Institut Royal Meteorologique de Belgique, Brussels.
GEOPHYSICAL OBSERVATIONS [OBSERVATIONS GEOPHYSIQUES] Monthly Bulletin, Sep. 1969
1969 44 p In FRENCH and DUTCH
Avail: CFSTI

Data from Dourbes Geophysical Observatory (Belgium) relating to geomagnetism, air radioactivity, ionospheric parameters, seismology, atmospheric electricity, and cosmic rays for September 1969 are presented. ESRO

N70-28911# Institut d'Aeronomie Spatiale de Belgique, Brussels.
THE ORIGIN OF NITRIC OXIDE IN THE TERRESTRIAL ATMOSPHERE
M. Nicolet 1970 23 p refs Submitted for publication *Its* Aeronomica Acta No. A-71-1970
Avail: CFSTI

Nitric oxide in the mesosphere and stratosphere is due to a downward transport from the thermosphere above the E layer where it is formed by a reaction of molecular oxygen with normal and excited nitrogen atoms produced by dissociative recombination of ionospheric ions. Author (ESRO)

N70-28914# Institut Royal Meteorologique de Belgique, Brussels.
GEOPHYSICAL OBSERVATIONS [OBSERVATIONS GEOPHYSIQUES] Monthly Bulletin, Nov. 1969
1969 38 p In FRENCH and DUTCH
Avail: CFSTI

Data from Dourbes Geophysical Observatory (Belgium) relating to geomagnetism, air radioactivity, ionospheric parameters, seismology, atmospheric electricity, and cosmic rays for November 1969 are presented. ESRO

N70-28915# Institut Royal Meteorologique de Belgique, Brussels.
GEOPHYSICAL OBSERVATIONS [OBSERVATIONS GEOPHYSIQUES] Monthly Bulletin, Dec. 1969
1969 37 p In FRENCH and DUTCH
Avail: CFSTI

Data from Dourbes Geophysical Observatory (Belgium) relating to geomagnetism, air radioactivity, ionospheric parameters, seismology, atmospheric electricity and cosmic rays for December 1969 are presented. ESRO

N70-28916# Institut Royal Meteorologique de Belgique, Brussels.
IONOSPHERIC AND COSMIC RAY OBSERVATIONS [OBSERVATIONS IONOSPHERIQUES ET DU RAYONNEMENT COSMIQUE] Monthly Bulletin, Dec. 1969
1969 30 p In FRENCH and DUTCH
Avail: CFSTI

Ionospheric data tables are presented for December 1969 from Dourbes, Belgium giving hourly values of the critical, maximum usable, and minimum reflection frequencies, together with virtual heights of the E and F regions etc. Variations of the neutron component intensity of the secondary cosmic radiation are also listed. ESRO

N70-28933# Institut d'Aeronomie Spatiale de Belgique, Brussels.
STUDY AND METHODS OF INVESTIGATING THE FUNDAMENTAL PHYSICS OF ATMOSPHERIC PHOTOCHEMISTRY [ETUDE ET OBTENTION DE DONNEES PHYSIQUES FONDAMENTALES POUR LA PHOTOCHIMIE ATMOSPHERIQUE]
M. Ackerman 1970 92 p refs In FRENCH; ENGLISH summary *Its* Aeronomica Acta No. A-69-1970
Avail: CFSTI

A study of the existing data by means of which the solar ultraviolet flux in the atmosphere can be evaluated is first presented. Results concerning the solar ultraviolet radiation obtained by means of stratospheric balloons and the absorption of oxygen in the Schumann–Runge bands in the laboratory are then summarized. They fill two important gaps among the required data. Author (ESRO)

N70-28938# Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie und Geophysik.
METEOROLOGICAL DATA, VOLUME III, NO. 1: COMPARISON OF OZONE MEASUREMENTS OF THE EUROPEAN OBSERVATION NETWORK [METEOROLOGISCHE ABHANDLUNGEN, BAND III, HEFT 1: VERGLEICH VON OZONMESSUNGEN DES EUROPAEISCHEN AUFSTIEG-NETZES]
Klaus Eckart Puls (Ph.D. Thesis—Aug. 1969) 1970 151 p refs In GERMAN; ENGLISH summary *Its* Meteorol. Abhandl., Band III, Heft 1
Avail: CFSTI

The Dobson spectrophotometer and the Brewer electrochemical ozone-sonde are described. The values of total ozone measured at the central European Dobson stations are compared, and it is shown that this network is not truly homogenous. The flight results are discussed by a comparison of the monthly and annual mean profiles over the individual stations. Though the shape of these profiles conform well between the different stations, there exist considerable and systematic differences in the absolute values which cannot be explained by the effects of latitude and circulation. It is shown that both the Dobson and the Brewer methods contribute to these differences. Author (ESRO)

N70-28964# Institut d'Aeronomie Spatiale de Belgique, Brussels.
OZONE AND HYDROGEN REACTIONS
M. Nicolet 1970 59 p refs Presented at the Gen. Sci. Assembly of Intern. Assoc. of Geomagnetism and Aeronomy, Madrid, 1–13 Sep. 1969. Submitted for publication *Its* Aeronomica Acta No. A-70-1970
Avail: CFSTI

In the stratosphere and lower mesosphere, dissociation of H2O is brought about mainly by a collision process with excited oxygen atoms produced by photodissociation of ozone. Such a collision process prevents the existence of normal mixing ratios for methane and molecular hydrogen at the stratopause. The rate of oxidizing processes falls off more rapidly with increase of altitude than does that of the vertical transport by eddy diffusion. Hydrogen molecules in the mesosphere are produced as a result of subsequent chemical reactions between hydroperoxyl radicals and hydrogen atoms. Hydrogen acts as a catalyst for the destruction of oxygen atoms and causes the ozone concentration to diminish pronouncedly in the mesosphere, from a factor of 1.5 at the stratopause to about a factor of 100 at the mesopause. The vertical distribtuon of water vapor is not affected in the stratosphere and mesosphere by the dissociation process since its re-formation is rapid. In the thermosphere, water vapor diffuses into the photodissociative region by eddy diffusion which carries it up at a sufficient rate to replace the hydrogen being lost. In spite of a continuous production of hydrogen peroxide molecules, their concentration should be small. It is thought that reactions with nitrogen oxides lead to nitric and nitrous acid molecules and are the mechanism responsible for the removal of nitric oxide which is produced in the thermosphere. Author (ESRO)

N70-28991# California Univ., Berkeley. Lawrence Radiation Lab.
PERMEABILITY INCREASES IN HARDHAT GRANODIORITE SAMPLES FACTURED BY EXPLODING FOILS
R. Quong 31 Nov. 1969 10 p refs
(UCRL-50783) Avail: CFSTI

A technique is described for generating shocks in sample materials by exploding foils. This technique has application in studying the shock-induced fractures that an underground nuclear explosion produces in the surrounding rock. In a series of tests with exploding foils, samples of Hardhat granodiorite were subjected to stresses ranging from about 2 to 10 kilobars, comparable to

stresses a few cavity radii out from an underground nuclear explosion. Before being shocked the specimens had permeabilities less than 0.000001 millidarcy. After the shock, matrix permeabilities as high as 0.5 millidarcy were measured. Although the permeability of these samples increased greatly as a result of the experimental shocks, it is still several orders of magnitude below the permeabilities measured in in situ Hardhat granodiorite after the shot. The difference may reflect the fact that the in situ measurements include larger scale effects such as flow through preexisting cracks and through fractures opened by the explosion along preexisting fault planes, types of flow passages which are not present in the samples. On the basis of these tests the exploding foil technique is regarded as a promising method for investigating shock-induced fracturing of earth materials. Author (NSA)

N70-29026# Deutsche Forschungsgemeinschaft, Bad Godesberg (West Germany).

INTERNATIONAL QUIET SUN YEAR (IQSY) 1964/65 [INTERNATIONALE JAHRE DER RUHIGEN SONNE (IQSY) 1964/65]

[1969] 92 p refs In GERMAN Proc. of Colloq. held at Bad Kreuznach, West. Ger., 4 - 5 Oct. 1968

Avail: CFSTI

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13. PULSATION INVESTIGATIONS AND GEOMAGNETIC ACTIVITY AT SUNSPOT MINIMUM M. Siebert (Gottigen Univ.) 3 p refs (See N70-29039 14-13)

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15. IONOSPHERE W. Dieminger (Max-Planck-Inst. fur Aeronomie 4 p (See N70-29041 14-13)

16. SOLAR ACTIVITY E. H. Schroeter (Gottingen Obs.) 5 p refs (See N70-29042 14-29)

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18. AERONOMY AND SPACE RESEARCH R. Luest (Max-Planck-Inst. fur Phys. und Astrophys.) 3 p (See N70-29044 14-13)

N70-29027# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).

WORLD DAYS [WELTTAGE]

B. Beckmann *In* Deut. Forschungsgemeinschaft Intern. Quiet Sun Yr. (IQSY) 1964/65 1969 8 p In GERMAN (See N70-29026 14-13)

Avail: CFSTI

The basis of the World Days warning system was the Ursigram-service. During the IQSY approximately 125 messages were received daily at the Darmstadt IUWDS-regional warning center from 62 observatories in 45 different codes. Daily advice on geoalerts were given, together with those from other regional warning centers, to the World Warning Agency (Ft. Belvoir, Virginia, USA). The geoalerts concerned geomagnetic storm-alerts, solar activity-alerts, etc., their ratio rate of announcement is also discussed. ESRO

N70-29028# Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie und Geophysik.

GEOALERTS [GEOALERTS]

Barbara Kriester *In* Deut. Forschungsgemeinschaft Intern. Quiet Sun Yr. (IQSY) 1964/65 1969 3 p In GERMAN (See N70-29026 14-13)

Avail: CFSTI

The meteorological part of the geophysical warning system (geoalert) concerns sudden stratospheric heatings, so that observations can be intensified during such periods. Stratospheric surveillance and the issue of Northern Hemisphere warnings was the responsibility of stratospheric analysis groups at Washington, Tokyo and Berlin and activities in this field during the IQSY are surveyed. ESRO

N70-29031# Koln Univ. (West Germany). Inst. fuer Geophysik und Meteorologie.

SECULAR OZONE VARIATIONS [SAEKULARER OZONGANG]

H. K. Paetzold *In* Deut. Forschungsgemeinschaft Intern. Quiet Sun Yr. (IQSY) 1964/65 1969 2 p In GERMAN (See N70-29026 14-13)

Avail: CFSTI

During the years 1957 to 1968 continuous measurements of the vertical ozone distribution were made above several Central European stations using the optical ozone Paetzold/Kulcke radiosonde. Twenty-five percent more ozone was measured between 18 and 28 km altitude during the IGY 1957/58 than during the IQSY 1964/65. Spectrograph ascents in the years 1951 to 1953 (the sunspot minimum before IQSY) showed the same low ozone values. ESRO

N70-29038# Erdmagnetisches Observatorium Wingst, Hoeftgrube (West Germany).

GEOMAGNETIC INVESTIGATIONS DURING THE METEOR EXPEDITION AND OBSERVATIONS WITHIN THE FRAMEWORK OF THE SECULAR PROGRAM [ERDMAGNETISCHE UNTERSUCHUNGEN BEI DER METEOR-EXPEDITION UND ARBEITEN IM RAHMEN DES SAEKULARPROGRAMMS]

D. Voppel *In* Deut. Forschungsgemeinschaft Intern. Quiet Sun Yr. (IQSY) 1964/65 1969 3 p In GERMAN (See N70-29026 14-13)

Avail: CFSTI

This report concerns: geomagnetic time variations and the equatorial electrojet at 30 deg W; magnetic survey of the westerly

part of the Romanche- and Chain rupture zones: geomagnetic secular variations in the German Federal Republic. ESRO

N70-29039# Gottingen Univ. (West Germany). Geophysikalisches Inst.
PULSATION INVESTIGATIONS AND GEOMAGNETIC ACTIVITY AT SUNSPOT MINIMUM [PULSATIONSUNTERSUCHUNGEN UND ERDMAGNETISCHE AKTIVITAET IM SONNENFLECKENMINIMUM]
M. Siebert *In* Deut. Forschungsgemeinschaft Intern. Quiet Sun Yr. (IQSY) 1964/65 1969 3 p refs In GERMAN (See N70-29026 14-13)
Avail: CFSTI

Investigations of geomagnetic pulsations during the IQSY, as well as observations of interplanetary magnetic fluctuations are discussed. Author (ESRO)

N70-29040# Max-Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany). Inst. fuer Ionosphaerenphysik.
AURORA AND AIRGLOW [POLARLICHT UND LUFTLEUCHTEN]
G. Lange-Hesse *In* Deut. Forschungsgemeinschaft Intern. Quiet Sun Yr. (IQSY) 1964/65 1969 7 p refs In GERMAN (See N70-29026 14-13)
Avail: CFSTI

During the 1954 IQSY intensive observations of optical aurora were made using all-sky cameras and the radio aurora was observed by amateurs. A synoptic observation network with filter photometers was set up for airglow measurements and the results are discussed. ESRO

N70-29041# Max-Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany). Inst. fuer Ionosphaerenphysik.
IONOSPHERE [IONOSPHAERE]
W. Dieminger *In* Deut. Forschungsgemeinschaft Intern. Quiet Sun Yr. (IQSY) 1964/65 1969 4 p In GERMAN (See N70-29026 14-13)
Avail: CFSTI

Results of IQSY ionospheric observations for the lower ionosphere, and the E and F regions are presented. A comparison of the observations at sunspot minimum and maximum shows that it is impossible to analyze the ionization mechanisms of the different layers using only ionospheric data. ESRO

N70-29044# Max-Planck-Institut fur Physik und Astrophysik, Munich (West Germany). Inst. fuer Extraterrestrische Physik.
AERONOMY AND SPACE RESEARCH [AERONOMIE UND WELTRAUMFORSCHUNG]
R. Luest *In* Deut. Forschungsgemeinschaft Intern. Quiet Sun Yr. (IQSY) 1964/65 1969 3 p In GERMAN (See N70-29026 14-13)
Avail: CFSTI

Measurements of ionospheric electron density using impedance probes, of the chemical composition of the neutral and ionized atmosphere using mass spectrometers, and of low energy radiation, during IQSY are given. ESRO

N70-29050# Departement d'Etudes et de Recherches en Technologie Spatiale, Toulouse (France).
THEORETICAL STUDY AND CALCULATION OF PARTICLE FLUX IN THE STABLE REGION OF THE MAGNETOSPHERE [EVALUATION THEORIQUE ET CALCUL DES FLUX DE PARTICULES DANS LA ZONE STABLE DE LA MAGNETOSPHERE]
Jean-Pierre Philippon (Ph.D. Thesis—Toulouse Univ.) 10 Mar. 1970 145 p refs In FRENCH
Avail: CFSTI

Analytical representations of the geomagnetic field together with magnetospheric phenomena are discussed with special emphasis on trapped particle belts. A more detailed description of the near and far magnetosphere is given and methods for evaluating the flux of particles received by a satellite are discussed. A computer program was written which considerably reduces the time involved, and the results are applied to the orbits of early French satellites. Author (ESRO)

N70-29059# Toulouse Univ. (France). Faculte des Sciences.
ENERGY AND ANGULAR DISTRIBUTION OF LOW ENERGY PARTICLES IN A DIFFUSE AURORA [REPARTITION ANGULAIRE ET ENERGETIQUE DES PARTICULES DE BASSE ENERGIE DANS UNE AURORE DIFFUSE]
Henri Reme (Ph.D. Thesis) 19 Dec. 1969 250 p refs In FRENCH
(Contracts CNES-258-1966; CNES-228-1967; CNES-238-1968)
Avail: CFSTI

This report concerns magnetic substorms and precipitated auroral particles in the atmosphere. The angular and energy distributions of these particles are not known in detail, especially for low energies, as they are difficult to detect. Auroral particle properties are analyzed, and a rocket spectrometer for detecting electrons and protons with energies less than 40 keV is described. The results of a Dragon rocket launch to 420 km during a magnetic disturbance and the auroral electron measurements are discussed. A method for computing electron diffusion in the atmosphere, based on a Fokker—Planck equation, leads to an evaluation of altitude geophysical perturbations. Proton results are compared with the electron ones, and it appears that substorms have their origin in magnetospheric phenomena as low altitude acceleration processes have little effect on auroral particles. ESRO

N70-29078# Environmental Research Corp., Alexandria, Va.
OBSERVED SEISMIC DATA, RULISON EVENT
14 Nov. 1969 79 p
(Contract AT(29-2)-1163)
(NVO-1163-197; PNE-R-16) Avail: CFSTI

The results of the processing of the observed ground motions from the Rulison event are presented. The observed peak particle amplitudes as a function of distance are compared with predictions based upon a 40 kt yield. The observed 5% horizontal component Pseudo-Relative Velocity (PSRV) spectra (peak response) are compared with the 40 and 60 kt spectral predictions. Data recorded at 36 instrument stations were processed. Author (NSA)

N70-29096# Institut Royal Meteorologique de Belgique, Brussels. Inst. d'Hygiene et d'Epidemiologie.
ATMOSPHERIC POLLUTION, SMOKE AND SULFUR DIOXIDE Monthly Bulletin, Sep. 1969 [POLLUTION ATMOSPHERIQUE, FUMEE ET ANHYDRIDE SULFUREUX Bulletin Mensuel, Septembre 1969]
1969 26 p In FRENCH and DUTCH
Avail: CFSTI

Tables relating to sulfur dioxide and smoke quantity (air pollution) measurements at different weather stations in Belgium in September 1969 are presented. A brief description is given of the air sampling apparatus. ESRO

N70-29111# Genoa Univ. (Italy). Ist. Geofisico e Geodetico.
GENOVA-MONTE CAPELLINO OBSERVATORY: IONOSPHERIC DATA, JANUARY - DECEMBER 1969
[1970] 64 p Sponsored partly by Consiglio Nazl. delle Ric.
Avail: CFSTI

Tables of ionospheric data derived from observations made at Genoa-Monte Capellino Observatory, Italy, from January to December 1969 are presented. Both vertical sounding and vertical incidence absorption measurements were made. Author (ESRO)

N70-29112# Meteorologisches Observatorium, Hohenpeissenberg (West Germany).
PROGRAM FOR ELECTRONIC EVALUATION OF RADIOSONDE ASCENTS [PROGRAMM ZUR ELEKTRONISCHEN AUSWERTUNG VON RADIOSONDENAUFSTIEGEN]
Oct. 1969 62 p refs In GERMAN *Its* Sonderbeobachtungen des Meteorol. Obs. Hohenpeissenberg No. 4
Avail: CFSTI

The large number of radiosonde ascents at the Hohenpeissenberg Observatory since 1966, necessitate the use of data processing equipment for the evaluation of the ozone data. A special program was written in FORTRAN 4 for doing this on a CDC 3800 computer. ESRO

N70-29115# Groupe de Recherches Ionospheriques, Paris (France).
EXCITATION AND MEASUREMENT OF THE LOWER HYBRID RESONANCE BY MEANS OF A ROCKET-BORNE QUADRUPOLE PROBE
C. Beghin *In its* Impedance Measurements of Quadrupole Probes 1970 7 p refs In FRENCH and ENGLISH (See N70-29114 14-25)
Avail: CFSTI

VLF mutual impedance probe of the quadrupole type was mounted on a rocket in an attempt to excite the ionospheric medium at frequencies near the lower hybrid resonance, at altitudes between 110 km and 480 km. Analysis of the measurements obtained confirmed the predictions of the theory, and emphasised the interest of this new research tool. Author (ESRO)

N70-29134# Meteorologisches Observatorium, Hohenpeissenberg (West Germany).
RESULTS OF THE AEROLOGICAL OZONE SOUNDINGS AND THE TOTAL OZONE MEASUREMENTS IN 1967 [ERGEBNISSE DER AEROLOGISCHEN OZONSONDIERUNGEN UND DER GESAMTOZONMESSUNGEN IM JAHRE 1967]
Sep. 1969 186 p ref In GERMAN *Its* Sonderbeobachtungen des Meteorol. Obs. Hohenpeissenberg No. 3
Avail: CFSTI

In the framework of the European ozone sounding network, ozone soundings were made from the Hohenpeissenberg Observatory in 1967, using Brewer-Mast-ozone-sondes. The results are given as ozonograms and tables, for which a Siemens 2002 computer was used. ESRO

N70-29163# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
SIMULATION MODELING OF THERMAL EFFLUENT IN AN IRRIGATION SYSTEM
D. E. Peterson and R. T. Jaske Jan. 1970 33 p refs
(Contract AT(45-1)-1830)
(BNWL-1277) Avail: CFSTI

Simulations of hourly average water temperatures along a 40 mile section of an irrigation canal were carried out by utilizing moving means of hourly regional weather data as input to the COLHEAT computer program. An analysis of the effects of steam plant thermal effluents on the canal indicates that irrigation canals may be an important future source of cooling water. NSA

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N70-27812# Naval Ship Engineering Center, Philadelphia, Pa.
THE CALIBRATION CORRELATION FUNCTION FOR POSITIVE DISPLACEMENT LIQUID METERS
David R. Keyser 16 Dec. 1969 139 p refs
(AD-702042; NAVSECPHILADIV-A-770) Avail: CFSTI CSCL 13/10

The report presents a correlation function for processing disc positive displacement oil meters. This correlation will predict the shift in the calibration curve due to differences in fluid conditions with an accuracy of plus or minus 1/2%. The prerequisite is a recent and valid calibration of that meter under known fluid conditions. The analysis and approach presented in this report are applicable to all designs of positive displacement flow meters. Author (TAB)

N70-27855# Bendix Corp., Kansas City, Mo.
INTERFEROMETER PRISM PDR 187
M. P. Schoeppner Sep. 1969 13 p
(BDX-613-127) Avail: CFSTI

Background of interferometric length measurement is given to support the description of a new miniature prism designed to simplify and stabilize a laser interferometer configuration. Advantages and applications of the improved interferometer system are presented. Author (NSA)

N70-27903# Stanford Univ., Calif. Dept. of Physics.
MODULATED INDUCTANCE MAGNETOMETERS
James E. Opfer Feb. 1970 11 p refs
(Contract F44620-70-C-0021)
(AD-701590; AFOSR-70-0512TR) Avail: CFSTI CSCL 14/2

The principles of operation of a modulated inductance magnetometer are described, and theoretical and practical limits to the sensitivity are discussed. A method to realize inductance modulation is then considered. Following this is a brief description of the results of the preliminary experiments and of the useful properties expected of such a magnetometer. Author (TAB)

N70-27948*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PROTON SENSITIVITY OF FILMS USED IN APOLLO TELESCOPE MOUNT SATELLITE MISSIONS
Richard A. Potter *In its* Radiation Phys. Res. at MSFC: Res. Achievements Rev., v. 3, 1969 p 43-58 refs (See N70-27942 14-24)
Avail: CFSTI CSCL 14E

The mission of the Apollo Telescope Mount (ATM) satellite requires large amounts of photographic film that will be subjected to proton irradiation in the South Atlantic Anomaly of the Van Allen radiation belts. The films to be flown were exposed to 130, 90, and 50-MeV protons at the Harvard University Cyclotron and to 17.6 and 10-MeV protons at the Oak Ridge National Laboratory Cyclotron. Tests results including curves of dose versus density for film types proposed for ATM missions are presented. Author

N70-27987*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
COUNT RATE METER (CRM)
O. I. Bugayenko *In its* Astrometry and Astrophys., No. 1 Apr. 1970 p 178-182 (See N70-27976 14-30)
Avail: CFSTI CSCL 14B

The schematic diagram of a count rate meter which measures the statistical frequency of signals admitted per unit input of the trigger, with Poisson distribution of the intervals between pulses, is described in this study. Author

N70-27988*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
AN ELECTROPHOTOMETER FOR LOW LUMINOUS FLUXES

L. A. Bugayenko et al. *In its* Astrometry and Astrophys., No. 1 Apr. 1970 p 183–199 refs (See N70-27976 14-30)
Avail: CFSTI CSCL 14B

A device intended for automatic determination of polarization components with a two-channeled instrument investigating low luminous fluxes according to pulse counts is described. The device is made of transistors. Author

N70-27997*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MERCURY ELECTROCHEMICAL COULOMETER AS A BATTERY STATE-OF-CHARGE INDICATOR
Richard R. Secunde and Arthur G. Birchenough 1970 8 p refs
(NASA-TM-X-52817; E-5331) Avail: CFSTI CSCL 14B

Use of a mercury-column electrochemical coulometer is discussed as a means of indicating the state of charge of secondary batteries. A state-of-charge indicator was designed, built in breadboard form, and tested. The coulometer is the element which integrates the ampere-hours into and out of the battery. The state of charge then is the difference between the known fully charged battery capacity and the net ampere-hours removed. The general nonlinear charge-discharge characteristics of a battery were matched through the use of operational-amplifier techniques. The results of electrical, temperature, and vibration tests demonstrate that the mercury-column coulometer is a feasible device around which a battery state-of-charge indicator suitable for space power systems, or other uses, might be built. Author

N70-28022# Dow Chemical Co., Golden, Colo. Rocky Flats Div.
COMPUTERIZED PREPARATION OF CALIBRATION SCALES: AN EXPANSION OF PROCESS VESSEL VOLUME CALIBRATION TECHNIQUES
Louis W. Doher 21 Nov. 1969 23 p refs
(Contract AT(29-1)-1106)
(RFP-1413) Avail: CFSTI

An expansion of the process vessel calibration technique is described. In the calibration procedure, experimental data are obtained by successively adding known volumes of a calibrating liquid to a vessel. A digital computer then calculates a calibration curve for each process vessel and prints out the certificate. A portion of the computer program tests the data for both systematic and random experimental errors, and accepts or rejects the calibration depending on the magnitude of these errors. In the described expansion, the computer also instructs a plotter to scribe an aluminum calibration scale from the calculated curve. Author (NSA)

N70-28090*# Kansas Univ., Lawrence. Center for Research.
AN ANALYSIS OF METHODS FOR CALIBRATING THE 13.3 GHz SCATTEROMETER
G. A. Bradley Houston, Tex. NASA Manned Spacecraft Center Dec. 1969 68 p ref
(Contract NAS9-10261)
(NASA-CR-109888; CRES-TR-177-1) Avail: CFSTI CSCL 14B

An analysis is presented of dynamic calibration methods that can be used in the 13.3 GHz scatterometer. Four candidate methods are considered with conclusions presented regarding the effectiveness of each method. A mathematical model is derived for each design with the signal frequency spectrum computed at critical points in the receiver. It is shown that the present method of calibration is unacceptable because the calibration signal amplitude is subject to variation. The error in scattering coefficient is shown to be especially sensitive to the bias point and linearity of the ferrite modulator. It is recommended than an injection system be incorporated in the 13.3 GHz scatterometer which uses a square-wave calibration signal. The analysis shows that this method will calibrate the scatterometer to the required accuracy with no error induced in the data record of the calibration system. Author

N70-28103*# California Univ., Livermore. Lawrence Radiation Lab.
THE LRL ELECTRON AND PROTON SPECTROMETER ON NASA'S ORBITING GEOPHYSICAL OBSERVATORY 5(E) (INSTRUMENTATION AND CALIBRATION)
H. I. West, Jr., J. H. Wujeck, J. H. Mc Quaid, N. C. Jensen, R. G. D'Arcy, Jr. et al 2 Jun. 1969 110 p
(NASA Order S-70014-G)
(NASA-CR-109982; UCRL-50572) Avail: CFSTI CSCL 20F

The design, construction, and calibration of the electron and proton experiment on the OGO-V satellite are described. A brief account of post-launch results is included. The electron spectrometer consists of two small permanent magnets used for energy analysis with electron detection provided by solid-state detectors. Background detectors are also provided. The energy range covered is approximately 60 to 2950 keV in 7 differential energy channels. The proton spectrometer consists of a single solid-state detector and a range-energy telescope of four solid-state detectors situated in line with the entrance aperture of the larger of the electron spectrometer magnets. The energy range is 0.1 to 94 MeV in 7 differential energy channels. Data handling in the experiment is primarily digital using a binary floating point compressional scheme. The experiment apertures are scanned relative to the stabilized spacecraft for obtaining pitch-angle distributions. Author

N70-28153# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
APPLICATION OF PHOTOGRAPHIC MASKING TO REDUCE THE EFFECT OF MOTION ON THE SHARPNESS OF THE PHOTOGRAPHIC IMAGE
Yu. L. Biryukov et al 10 Dec. 1969 99 p Transl. into ENGLISH from Zh. Nauch. i Prikład. Fot. i Kinematografii (Moscow), v. 13, no.6, 1968 p 462–463
(AD-702291; FTD-HT-23-487-69) Avail: CFSTI CSCL 14/5

A method is proposed for reducing motion (blurring) of photographic images. The method requires obtaining two photographs of the same object with different rates of motion and exposures and substraction of optical densities. The origin and direction of motion of the photos must be identical. A 10-fold decrease of image motion is claimed; reduction of small motions is said to produce a resolution equal to 60-70 percent of that for a photograph taken without motion. Author (TAB)

N70-28203# Ballistic Research Labs., Aberdeen Proving Ground, Md.
THE DESIGN AND DYNAMIC BALANCING OF SPINNING MODELS AND A TESTING TECHNIQUE FOR OBTAINING MAGNUS DATA IN WIND TUNNELS
Anders S. Platou, Raymond Colburn, and John S. Pedgonay Oct. 1969 40 p refs
(AD-699803; BRL-MR-2019) Avail: CFSTI CSCL 14/2

The report presents a method of designing spinning wind tunnel models and a testing technique for obtaining accurate Magnus measurements on these models. Author (TAB)

N70-28211# Explosives Research and Development Establishment, Waltham Abbey (England).
EIGHT-CHANNEL AUTOMATIC RECORDING VISCOMETER
D. H. L. Mansell 13 Jun. 1969 44 p
(AD-700164; ERDE-10/M/69) Avail: CFSTI CSCL 14/2

An instrument has been designed for the measurement of specific viscosities of polymer solutions. It operates sequentially eight Ubbelhode viscometers and prints out the time interval for a solution, falling under gravity through a precision bore capillary tube, to pass between two reference levels. An interrupted light beam technique is used to obtain the fall times of the solutions. Previous methods using this technique failed at higher temperatures due to the limitations of the detectors. This defect has been overcome by employing fibre-optic light guides as coupling elements to the viscometer, thus allowing the detectors and light sources to be mounted externally where they are not subjected to the higher temperatures. Author (TAB)

N70-28235*# Avco Corp., Lowell, Mass. Applied Technology Div.
CALIBRATION OF AN ION MOBILITY SPECTROMETER Final Report, 28 May 1968 – 30 Sep. 1969
30 Sep. 1969 58 p refs
(Contract NAS5-11131)
(NASA-CR-110003; AVSD-127-70-RR) Avail: CFSTI CSCL 20F

The objective was to demonstrate that a correlation is possible between ion mobility spectra and ion mass spectra. The experimental study was conducted in the low-pressure wind tunnel at simulated altitudes between 25 and 60 km. Subsonic air flow velocities were obtained by bleeding gas through the wind tunnel into an evacuated ballast tank. The mobility of ions generated by either a corona discharge or a radioactive source were measured with a cylindrical Gerdien chamber. A quadrupole mass spectrometer mounted within a differentially pumped chamber was used to measure the mass spectra. Ions entered the quadrupole through a small (0.020 inch diameter) aperture. Mobility and mass spectra have been recorded; however, a confident interpretation of the mass spectra is prevented because of uncertainties in the behavior of ions in the region of the aperture. Author

N70-28264# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Inst. Fiziki Vysokikh Energii.
THE DIFFERENTIAL-THRESHOLD CHERENKOV COUNTER
Yu. D. Prokoshkin 1969 11 p refs In RUSSIAN
(IFVE-SEF-69-7) Avail: AEC Depository Libraries

A modification of the Cherenkov counter (a differential-threshold Cherenkov counter) is described. The counter has high resolution and a large angular aperture. Author (NSA)

N70-28278# Air Force Systems Command, Wright-Patterson AFB, Ohio. Flight Dynamics Lab.
PRESSURE MEASUREMENT IN THE 0.0001 TO 0.0000000001 TORR RANGE
Vernon L. Mangold Dec. 1969 78 p refs
(AD-700983; AFFDL-TR-69-49) Avail: CFSTI CSCL 14/2

The report documents the experimental results of pressure measurements made with a multiple orifice calibration system in the pressure range of 0.0004 to 0.0000000001 torr. The maximum reported error in the measurement of the pressure in the final chamber of the multiple orifice system is 11.2% when the pressure in the first chamber is referenced to a McLeod gauge which is used as a primary standard in the pressure range of 0.0004 to 0.00001 torr. The report includes discussions on calibration of vacuum gauges, measurement of small gas flows, error analysis in calculating pressures, vacuum gauge calibration report format, and procedures for calibrating a multiple orifice system. Author (TAB)

N70-28337*# National Bureau of Standards, Washington, D.C. Temperature Section.
AN INVESTIGATION OF W-3% Re AND W-25% THERMOELEMENTS IN VACUUM, ARGON AND HYDROGEN Final Report
G. W. Burns and W. S. Hurst 10 Mar. 1970 33 p refs
(NASA Order C-30968-B)
(NASA-CR-72639) Avail: CFSTI CSCL 14B

The individual thermoelements, and hence the W-3% Re versus W-25% Re thermocouple pair, experienced in a shift in the emf-temperature relationship on initial heating. In argon and hydrogen, the shift was less than 1% at 2000 K for the thermocouple pair. After the initial shift, the thermoelements exposed in argon and hydrogen experienced no significant further change in their emf-temperature relationship for periods up to 1000 hours. Both the W-3% Re and the W-25% Re thermoelements, when exposed in vacuum at 2400 K and above, drifted continually from original calibration as a result of preferential loss of Re by evaporation. The thermoelements were examined for chemical and structural changes by electron microprobe analysis and by conventional metallographic techniques. Author

N70-28377# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
REALISTIC UNCERTAINTIES AND THE MASS MEASUREMENT PROCESS: AN ILLUSTRATED REVIEW
Paul E. Pontius and Joseph M. Cameron *In its* Precision Meas. and Calibration, Vol. 1 Feb. 1969 p 1–20 (See N70-28376 14-19)
(NBS-Monograph-103) Avail: SOD $5.50

The concepts and operations involved in measuring the mass of an object are reviewed. The importance of viewing measurement as a production process is emphasized and methods of evaluating process parameters are presented. The use of one of the laboratory's standards as an additional unknown in routine calibration provides an accuracy check and, as time goes on, the basis for precision and accuracy statements. Author

N70-28378# National Bureau of Standards, Washington, D.C.
REALISTIC EVALUATION OF THE PRECISION AND ACCURACY OF INSTRUMENT CALIBRATION SYSTEMS
Churchill Eisenhart *In its* Precision Meas. and Calibration, Vol. 1 Feb. 1969 p 21–47 refs Presented at NBS Std. Lab. Conf., Boulder, Colo., 8–10 Aug. 1962 *Its* Paper 67C2-128 (See N70-28376 14-19)
Avail: SOD $5.50

A particular measurement operation cannot be regarded as constituting a measurement process unless statistical stability of the type known as a state of statistical control has been attained. It is necessary to be definite on what variations of procedure, apparatus, environmental conditions, observers, operators, etc., are allowable in repeated applications of what will be considered to be the same measurement process applied to the measurement of the same quantity under the same conditions. To be realistic, the allowable variations must be of sufficient scope to bracket the circumstances likely to be met in practice. Furthermore, any experimental program that aims to determine the standard deviation of a measurement process as an indication of its precision, must be based on approprate random sampling of this likely range of circumstances. Ordinarily the accuracy of a measurement process may be characterized by giving the standard deviation of the process and credible bounds to its likely overall systematic error. Author

N70-28381# National Bureau of Standards, Washington, D.C.
UNCERTAINTIES IN CALIBRATION
W. J. Youden *In its* Precision Meas. and Calibration, Vol. 1 Feb. 1969 p 63–68 refs Repr. from IRE Trans. on Instrumentation, v. 1, no. 3, 4, Dec. 1962 Presented at Intern. Conf. on Presision Electromagnetic Meas., 1962 (See N70-28376 14-19)
Avail: SOD $5.50

Methods for making comparisons between standards and items undergoing calibration are presented. These methods may be used in a variety of measurements. The purpose is to accumulate data that provide objective estimates of the precision and that are also useful in detecting sources of systematic errors. This purpose is achieved in using some standard statistical designs in the scheduling of the work program. The problems of stating the uncertainty and of combining the uncertainties in a chain of calibrations are discussed. Author

N70-28385# National Bureau of Standards, Washington, D.C.
NEW EXPERIMENTAL DESIGNS FOR PAIRED OBSERVATIONS
W. J. Youden and William S. Connor *In its* Precision Meas. and Calibration, Vol. 1 Feb. 1969 p 86–91 ref *Its* Res. Paper 2532 (See N70-28371 14-19)
Avail: SOD $5.50

There are many experimental situations in which observations naturally occur in pairs. From v quantities to be compared, v(v-1)/2 distinct pairs can be formed, so that for even moderately large v, the accompanying number of observations may be prohibitively large. Or, even if the work can be done, the precision of the

estimates of the effects of the quantities and the experimental error may be greater than is needed. In either event, a subset of the pairs should be used. If the arithmetic is to be manageable, this subset must be chosen with care. Such a subset is described and its analysis is given in detail. Author

N70-28386# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
DESIGN AND STATISTICAL PROCEDURES FOR THE EVALUATION OF AN AUTOMATIC GAMMA-RAY POINT-SOURCE CALIBRATOR
S. B. Garfinkel, W. B. Mann, and W. J. Youden *In its* Precision Meas. and Calibration, Vol. 1 Feb. 1969 p 92-102 refs *Its* Paper 70C2-219 (See N70-28376 14-19)
Avail: SOD $5.50

A description is given of the mechanical design and operation of an automatic gamma ray point-source calibrator. The use of statistical design in experiments for evaluating performance factors, such as interchangeability of stations and run differences using the same data obtained in comparisons of the sources, is described in detail. Author

N70-28387# National Bureau of Standards, Washington, D.C.
INSTRUMENTAL DRIFT
W. J. Youden *In its* Precision Meas. and Calibration, Vol. 1 Feb. 1969 p 103-107 refs Repr. from Science, v. 120, no. 3121, 22 Oct. 1954 p 627-631 (See N70-28376 14-19)
Avail: SOD $5.50

The use of statistical design to show that an instrument stays in adjustment or to introduce appropriate adjustments if there is drift is discussed. The statistical method is outlined for several different situations. Problems of making repeated measurements independent of one another and of ensuring that the operator forgets previous readings are considered. N.E.N.

N70-28392# National Bureau of Standards, Washington, D.C. Applied Mathematics Div.
MEASUREMENT AGREEMENT COMPARISONS AMONG STANDARDIZING LABORATORIES. MEASUREMENT AGREEMENT COMPARISONS
W. J. Youden *In its* Precision Meas. and Calibration, Vol. 1 Feb. 1969 p 146-150 refs (See N70-28376 14-19)
(NBS-Misc-Publ-248) Avail: SOD $5.50

The best source of information on the measurement errors in comparisons is found in the records of the comparisons regularly carried out by a laboratory. This requires that some of the comparisons must be repeated, either directly or indirectly. An item, A, may be compared with a standard, S, and the comparison repeated. Generally it is better to plan the work so that the operator is not directly aware of how well his results check. If two items, A and B, are each compared with S, and then A and B compared directly, the additional measurement provides a check on the measurement process. Thus in addition to the direct comparison of A with S there is the indirect comparison obtained by adding (A-B) to (B-S). The sum of these two comparisons would check the direct result exactly if the measurements could be made without error. The discrepancy between (A-S) and (A-B)+(B-S) must arise from measurement error. Information collected over a sequence of such triads soon provides a sound basis for evaluating measurement error. This example and similar ones are discussed in some detail. Author

N70-28401# National Bureau of Standards, Washington, D.C.
UNCERTAINTIES ASSOCIATED WITH PROVING RING CALIBRATION
Thomas E. Hockersmith and Harry H. Ku *In its* Precision Meas. and Calibration, Vol. 1 Feb. 1969 p 257-264 refs (See N70-28376 14-19)
Avail: SOD $5.50

A method of error analysis is presented using data obtained from dead-weight calibration of various capacity proving rings. A breakdown of the errors into components by statistical methods and their combination into a final uncertainty statement is discussed in detail. Graphical representations are used in several places to help in the exposition. Extension of the analysis and method of handling calibration data for multiple proving ring setups is discussed in an effort to show that the same general method of analysis should be adequate. Author

N70-28429# Argonne National Lab., Ill. Reactor Engineering Div.
DESIGN PARAMETERS AND PERFORMANCE CHARACTERISTICS OF A MINIATURE PRESSURE-TRANSDUCER SYSTEM USING A FLUID-FILLED BELLOWS SENSOR
John R. Folkrod Oct. 1969 23 p
(Contract W-31-109-eng-38)
(ANL-7574) Avail: CFSTI

Optimal design parameters are developed and two working models are assembled to demonstrate the feasibility of transmitting fission gas pressures generated in LMFBR type fuel pins via a miniature, NaK filled bellows-capillary tube to a strain gauge transducer located outside the core environment. Several cleaning and filling procedures were required before the slightest compression of the bellows resulted in essentially full deflection of the transducer diaphragm, indicative of a voidless fill. Bellows failure due to nickel embrittlement precluded system calibration. It is concluded that, with improvements in filling techniques, a commercially available stainless steel bellows of 0.220 in. OD coupled to a capillary tube of 0.012 in. ID would satisfy criteria established for LMFBR fission gas pressure sensors. Author (NSA)

N70-28461*# Massachusetts Inst. of Tech., Cambridge. Center for Space Research.
A PRELIMINARY DESIGN STUDY FOR A COSMIC X-RAY SPECTROMETER Interim Report
George W. Clark and Herbert W. Schnopper 1969 57 p refs
(Contract NAS8-24585)
(NASA-CR-102651) Avail: CFSTI CSCL 20F

The breadboard spectrometer system is described and the results are given of an evaluation with this spectrometer of different crystals. Results are also presented of theoretical studies made of the optical properties of the spectrometer used with an X-ray telescope, and a preliminary design and analysis of detector systems that can be used with the spectrometer. Author

N70-28486*# Bellcomm, Inc., Washington, D.C.
APOLLO 12 MULTISPECTRAL PHOTOGRAPHY EXPERIMENT
A. F. H. Goetz 20 Feb. 1970 16 p refs
(Contract NASw-417)
(NASA-CR-110087; TM-70-2015-1) Avail: CFSTI CSCL 14E

The Lunar multispectral photography experiment, S-158, was successfully carried out on Apollo 12. A number of photographs were returned in the blue, green, red and infrared portions of the optical spectrum. Preliminary data analysis shows no color boundaries in the frame containing the Fra Mauro formation and the Apollo 13 landing site. Color differences were found in the frame containing Lalande eta, establishing the existence of small-scale color differences on the lunar surface. Author

N70-28563# Toledo Univ., Ohio.
MOLECULAR STRUCTURE STUDIES: A GAS PHASE ELECTRON DIFFRACTION UNIT EMPLOYING COUNTING TECHNIQUES Technical Progress Report, 1 Jun. -18 Dec. 1969
H. Bradford Thompson Dec. 1969 8 p
(COO-2058-1) Avail: CFSTI

This report covers progress during the first 6 1/2 months of a program to develop an apparatus of unique design for gas phase electron diffraction. The unit is to employ particle counting

techniques rather than the conventional combination of rotating sector and photographic plates. The design is to be competitive with the photographic method in terms of sample required, and superior in versatility and freedom from a number of sources of uncertainty. The automated character of the unit will make possible a precision greater than presently attainable, and thus permit studies of larger molecules and of isotopic effects on bonding. The techniques to be tested should apply to gas phase X-ray and neutron diffraction. Author

N70-28606 European Organization for Nuclear Research, Geneva (Switzerland). Nuclear Physics Div.

BEAM PATH MAPPING FOR THE ISOLDE ISOTOPE SEPARATOR

J. Camplan and S. Sundell *In its* The ISOLDE Isotope Separator On-Line Facility at CERN 19 Jan. 1970 p 31-37 (See N70-28603 14-22)

Copyright. Avail: Issuing Activity

The positioning of one or several collecting devices or detectors to intercept beams of specified mass numbers is discussed. Measurements of the beam trajectories in the collector chamber and of the dispersion as a function of the central beam are investigated, and results of checking the beam profile are given. Author

N70-28607 Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Physics.

THE TAU-METER: A COLLECTOR-DETECTOR ARRANGEMENT FOR ISOLDE

M. Alpsten, G. Andersson, A. Appelqvist, B. Bengtsson, E. Borgentun et al *In* CERN The ISOLDE Isotope Separator On-Line Facility at CERN 19 Jan. 1970 p 39-54 (See N70-28603 14-22)

Copyright. Avail: Issuing Activity

The collector-detector system that is movable along the focal plane of the isotope separator is described. The instrumentation in the collector chamber includes a magazine located above the plane of the ion beams, from which one collector at a time is allowed to fall downward in steps, first to a collecting position where it intercepts a chosen beam, then to a measuring position just below, and finally to a waste container. The programming unit is built to permit pulse-height analyses in either detector position, while half-life determinations by multiscaling or multianalysis are restricted to Mode 1. Author

N70-28615*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.

TIME OF FLIGHT MASS SPECTROMETRY FOR IONOSPHERIC MEASUREMENTS: THEORY AND EXPERIMENTS

M. F. Zabielski 10 Apr. 1970 129 p refs

(Grant NGR-39-009-129)

(NASA-CR-110177; SR-353) Avail: CFSTI CSCL 20F

Theoretical analyses are made of cylindrical, planar, and spherical time-of-flight mass spectrometers with two accelerating regions. The results of these analyses are compared and indicate that for the flight paths considered, the space focusing of the spherical device is superior to that of the other two geometries and the space focusing of the cylindrical geometry is superior to that of the planar geometry. The results of an experimental investigation of a small cylindrical wedge time-of-flight mass spectrometer are presented. These results suggest that this instrument is suitable for making measurements at least down to the middle of the D-region of the ionosphere. The primary reasons for this suitability are high sensitivity and the ability to function at the high ambient pressures encountered in the D-region. The mechanical and electronic design of an experiment package suitable for flight on a small sounding rocket is described. The mechanical design is presented within the requirements imposed by the small rocket. The electronic design is presented in block function form. Suggestions for future experiment packages are also given. Author

N70-28623*# Perkin-Elmer Corp., Pomona, Calif. Aerospace Systems.

DESIGN AND CONSTRUCTION OF HEATED ION SOURCE FOR ORGANIC ANALYSIS AND DESIGN AND CONSTRUCTION OF DOUBLE FOCUSING MASS SPECTROMETER ANALYZER Final Report

Dec. 1969 20 p Prepared for JPL

(Contracts NAS7-100; JPL-952424)

(NASA-CR-110150) Avail: CFSTI CSCL 20F

The pyrolysis-gas chromatograph-mass spectrometry experiment offers an indirect approach to the question of life existence on Mars. The identification depends on a chemical interpretation of mass spectra of specific organic materials as indirect evidence of the existence or previous existence of life. The instrumentation can also serve a dual purpose, for example, when the instrumentation is used without the pyrolysis-gas chromatograph sections it can also provide an analysis of the Martian atmosphere. The mass spectrometer selected for this application is a double focusing sector instrument of the Johnson-Nier type. A 90 deg electrostatic sector, 60 deg magnetic sector mass spectrometer was previously built, primarily intended for atmospheric analysis. The modifications of the previous instrument in order to improve its performance, reduce its size, and make it more suitable for organic analysis are described. The primary modifications performed were: (1) the addition of an ion source heater for heating the ion source to 250 C; (2) the modification of the ion source magnet for increased field strength and placement of the anode outside of the ionizing region; (3) change in analyzer geometry; and (4) electric sector redesign. Author

N70-28715*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

RADIOGRAPHIC INTERPRETATION GUIDE FOR ALUMINUM ALLOY WELDS

P. C. Duren and E. R. Risch 19 May 1970 68 p refs

(NASA-TM-X-53939) Avail: CFSTI CSCL 14E

The problem of radiographic interpretation has plagued the X-ray method of nondestructive testing since its beginning. In an attempt to achieve a more accurate interpretation of radiographic images of aluminum alloy welds, a program designed to correlate specific images with corresponding discontinuities was initiated. Radiographs were made of welds that contained different types of discontinuities. Subsequent metallographic studies were made to confirm the image types and shapes as depicted in the radiographs. These experiments required very precise welding techniques to produce the various types of discontinuities found in typical aluminum welds. Exact radiographic techniques and careful metallographic methods were also necessary to achieve program objectives. Lack of agreement on terminology has also plagued the advancement of radiographic interpretation. Therefore, the radiographic terms used in this report have been carefully defined in order to eliminate as many interpretational errors as possible. The resultant data show clearly that radiographic interpretation can be placed on a scientific basis. Author

N70-28732*# Pittsburgh Univ., Pa. Space Research Coordination Center.

A METHOD FOR SODIUM DAYGLOW MEASUREMENT USING A ZEEMAN PHOTOMETER WITH A POLAROID FILTER

Bruce William Guenther (M.S. Thesis) 13 Feb. 1970 102 p refs

(Grants NGL-39-011-002; NSF GP-4435; NSF GA-1237)

(NASA-CR-110202; SRCC-120) Avail: CFSTI CSCL 20F

A method for measuring dayglow atmospheric sodium emissions with a ground based Zeeman photometer is presented. A direct measurement of the polarization of the sodium doublet and Rayleigh scattered background is taken by placing polaroid filter in front of the input optics. The photometer utilizes a sodium vapor scattering chamber between the poles of a magnet. In this system, all

changes in the degree of polarization and the plane of polarization mean a change in the signal attenuation in the polaroid, but no change in the transition probabilities. F.O.S.

N70-28765# Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics.
A NOVEL MEASURING UNIT WITH INTEGRATED CIRCUITS FOR TIME DISTRIBUTION MEASUREMENTS IN REACTOR PHYSICS
I. Palmai and B. Hubert 1969 9 p
(KFKI-31/1969) Avail: AEC Depository Libraries

The design of a time distribution measuring unit for reactor physics measurements is described. The decay of a neutron pulse injected into the core is measured in a time analysis mode; Rossi-alpha, rod, drop, multidetector, and Feynman-type measurements with this integrated circuit-multichannel analyzer instrumentation are discussed. NSA

N70-28834*# Techtran Corp., Glen Burnie, Md.
A VARIATION OF AN ENGINEERING DESIGN FOR A TOTAL-ABSORPTION SPECTROMETER FOR COSMIC RAY EXPERIMENTS [OB ODNOM VARIANTE TEKHNICHESKOGO ISPOLNENIYA SPEKTROMETRA POLNOGO POGLOSHCHNENIYA V OPYTAKH S KOSMICHESKIMI LUCHAMI]
Kh. D. Koshumbekov Washington NASA Jun. 1970 10 p refs Transl. into ENGLISH from Izv. Akad. Nauk Kaz. SSR, Ser. Fiz.-Mat. Nauk (Alma-Ata), vol. 5, Nov.-Dec. 1967 p 50-55
(Contract NASw-2037)
(NASA-TT-F-12920) Avail: CFSTI CSCL 20F

The design and operation of a total-absorption spectrometer using chambers (structurally similar to spark chambers) in which the working inert gas is replaced by a hot mixture of gases whose pressure, temperature, and composition are close to the spontaneous-combustion threshold are described. The presence of an electrically negative gas in the mixture ensures a memory time (measured in milliseconds) during which it is possible to completely record the information from the ionization chambers or scintillators. The occurrence of a sufficient quantity of oxygen atoms along the particle track (due to the formation of electron avalanches) causes a higher rate of chain-reaction formation, leading to the origin of flash points along the track. Author

N70-28858# Sandia Corp., Albuquerque, N.Mex.
PIEZOELECTRIC FIELD EFFECT STRAIN GAUGE
J. C. Crawford Jan. 1970 43 p refs Sponsored by AEC
(SC-RR-70-53) Avail: CFSTI

In this device the strain produced in the ceramic substrate produces a change in conductivity of the semiconductor film. Experimental devices have been made by depositing approximately 200 A thick tellurium films on polished PZT-4 substrates. Devices with gauge factors as high as 3700 have been obtained with linear response extending over three orders of magnitude of strain. Gauge constants are calculated and found to be approximately 20% higher than those measured experimentally. At present these devices are useful only for dynamic strain measurements (periods less than approximately 1 sec) due to an instability in the semiconductor. The theory of operation, experimental results, and calculations on the dependence of the guage sensitivity to the direction of the polarization axis are discussed. Author

N70-28874# Royal Aircraft Establishment, Farnborough (England).
AN EXPERIMENTAL AUTOMATIC WIDE RANGE INSTRUMENT TO MONITOR THE ELECTROSTATIC FIELD AT THE SURFACE OF AN AIRCRAFT IN FLIGHT
G. A. M. Odam and R. H. Forrest Oct. 1969 36 p refs
(RAE-TR-69218) Copyright. Avail: CFSTI

A device was constructed to monitor automatically the magnitude and polarity of electrostatic fields associated with an aircraft in flight. It is small, self-contained apart from an ancillary photographic recorder, and operates from the aircraft 400 Hz supply. Logarithmic amplifier techniques are used to accomodate the large signal range of 400 V/m to 300 kV/m. Author (ESRO)

N70-28878# Mound Lab., Miamisburg, Ohio.
X-RAY GAGING SYSTEM FOR DENSITY DETERMINATION OF ENCAPSULATED MATERIALS
C. F. Draut and P. L. Johnson 12 Feb. 1970 17 p
(Contract AT-33-1-GEN-53)
(MLM-1645) Avail: CFSTI

An X-ray gaging method was developed to determine the density of pressed powders. A partially automatic gaging system was built utilizing a Sheffield Measuray Model 25PT noncontact X-ray gage; the basic components are an X-ray tube and transformer, an aperture plate to collimate the incident radiation, and a detector (pickup cell) to monitor the remaining radiation signal. A system calibration procedure was developed which will allow the density determination of pressed powders held in dissimilar containers. This capability necessitated the two scan technique: first, the X-ray attentuation of the empty container prior to loading is measured; and then, the attenuation of the loaded container is measured. The density of the pressed material is then determined graphically from these measurements. Author

N70-28890# Air Force Cambridge Research Labs., Bedford, Mass.
FOURIER ANALYSIS AND COMPENSATION OF STAGGER ERRORS OF SEMIKINEMATIC THEODOLITE AXES
Tibor Farkas Feb. 1970 22 p refs Transl. into ENGLISH from Allgem. Vermessungsnachr. (Karlsruhe), v. 10, 1969 p 483-491
(AD-701007; AFCRL-70-0075; AFCRL-Trans-65) Avail: CFSTI CSCL 17/8

A complete description, discussion and scientific analysis of stagger errors found in the vertical axis of a theodolite is presented. Stagger errors are the deviations of the real vertical axis of a theodolite from the ideal axis which are due to imperfections in vertical axis bearings. An understanding of the stagger error source is a prerequisite to high precision geodetic surveying involving theodolites. Author (TAB)

N70-28896# Oak Ridge National Lab., Tenn.
A VARIABLE-GRID RESPONSE MATRIX FOR A 5 TIMES 4 NAI SCINTILLATION SPECTROMETER
Frances Pleasonton and R. W. Lide 5 Feb. 1970 17 p refs
(ORNL-TM-2865) Avail: CFSTI

A 16 × 16 triangular response matrix was developed for analysis of the continuous pulse-height distribution observed from prompt gamma rays emitted in fission. It combines information from measured pulse-height distributions, obtained with calibrated gamma ray sources, with Monte Carlo calculations of distributions to be expected from monoenergetic sources detected in the geometry of the experiment. Author (NSA)

N70-28924# California Univ., Livermore. Lawrence Radiation Lab.
AN FM ACCELERATION/VELOCITY MEASUREMENT SYSTEM
Sam Spataro Feb. 1970 36 p refs Presented at the Instrumentation for Nucl. Weapon Effects Symp., Albuquerque, N.Mex., 12-13 Mar. 1970 Sponsored by AEC
(UCRL-72193; CONF-700302-1) Avail: CFSTI

A constant bandwidth measurement system using a variable reluctance accelerometer or velocity transducer to frequency modulate a dual-oscillator, balanced modulator circuit is described. Features include a remote calibration capability in the oscillator and the ability to use the same electronics for a variety of tranducers. An associated signal conditioner and constant current regulator provides power to as many as six transducer-oscillators, multiplexes

the carriers with a reference frequency, and delivers them to an end recorder or telemetry link. Data are played back through standard discriminators and digitizing equipment and are processed by a computer which yields time history plots of acceleration, velocity, and displacement. This system is used for measuring ground motion induced by nuclear detonations. Author (NSA)

N70-28972# Oak Ridge National Labs., Tenn. Chemistry Div.
CONSTRUCTION AND USE OF HIGH RESOLUTION PHOTOELECTRON SPECTROMETER
Bailey Price Pullen (Ph.D. Thesis--Tennessee Univ., Knoxville) Feb. 1970 129 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2794) Avail: CFSTI

A He discharge lamp which emits primarily 21.22 eV photons in conjunction with an electrostatic deflection type electron spectrometer was constructed for irradiating compounds and then submitting the ejected photoelectrons to energy analysis. For this energy analysis, the photoelectrons are allowed to pass through two small slits into the region between two spherical sector plates held at a predetermined voltage difference. Photoelectrons of a given energy then emerge through two exit slits, the outer one positioned 180 deg from the first entrance slit, where they are detected by an electron multiplier. The experimental ionization energies are compared with available theoretical values and other experimental data and in some instances molecular orbital assignments are made for energy values obtained. Broad double maximum bands which were observed in the case of CH4, SiH4, and GeH4 are discussed in terms of Jahn-Teller distortion for the positive ions. The spectrum of SF6 revealed possible Jahn-Teller splitting also, but the CF4 spectrum did not. Possible correlation of the methane spectrum with interstellar space data is discussed. Spin-orbital splitting was not observed in the spectrum of CH3Cl, contrary to what one might expect. Author

N70-28984# California Univ., Berkeley. Lawrence Radiation Lab.
NEW MEASUREMENTS OF STAR PRODUCTION IN NUCLEAR EMULSIONS AND APPLICATIONS TO HIGH-ENERGY NEUTRON SPECTROSCOPY
H. Wade Patterson, Harry H. Heckman, and Jorma T. Routti 1 Oct. 1969 18 p refs Presented at the 2d Intern. Conf. on Accelerator Dosimetry and Experience, Stanford, Calif., 5-7 Nov. 1969
(Contract W-7405-eng-48)
(UCRL-19389; CONF-691101-14) Avail: CFSTI

When stars are produced in nuclear emulsions by high-energy neutrons there is a strong dependence of the average number of grey prongs per neutral on the incident neutron energy. This dependence was measured by exposing emulsion stacks to 27-, 105-, and 230-MeV neutrons produced by deuteron stripping, and to 4-GeV neutrons produced by 6.2-GeV protons incident on a copper target. These results were used to obtain information on the energy distribution of an unknown neutron spectrum from the measurement of the average number of grey prongs per star. A parametric representation of the neutron spectrum is assumed, defined by the maximum energy and by the slope of the spectrum on a logarithmic scale, and the average number of grey prongs are calculated for a wide range of these parameters. These results are expressed on a single graph which is used to relate the measured average number of grey prongs to a simple exponential spectral shape. The results obtained for a number of accelerator and cosmic-ray spectra are in good agreement with results obtained with threshold detector methods. Author (NSA)

N70-28988# California Univ., Berkeley. Lawrence Radiation Lab.
SOME THOUGHTS ON THE DATA ACQUISITION PROBLEM OF HIGH-ENERGY PHYSICS EXPERIMENTS
Frederick A. Kirsten Nov. 1969 11 p refs Presented at 16th Nucl. Sci. Symp., San Francisco, 29-30 Oct. 1969
(Contract W-7405-eng-48)
(UCRL-19383; CONF-691017-8) Avail: CFSTI

Some of the questions that arise when considering a standard data-bussing system are discussed. The discussion is restricted to applications in high-energy physics instrumentation. It is pointed out that it is necessary to provide for the operation of such systems without on-line computers. Author (NSA)

N70-28990# California Univ., Berkeley. Lawrence Radiation Lab.
PRESENT AND PROJECTED USES OF MULTIWIRE SPARK CHAMBERS IN HEALTH PHYSICS
Alessandro Rindi Oct. 1969 17 p refs Presented at 2d Intern. Conf. on Accelerator Dosimetry and Experience, Stanford, Calif., 5-7 Nov. 1969
(Contract W-7405-eng-48)
(UCRL-19363; CONF-691101-15) Avail: CFSTI

The development and operation of multiwire spark chambers with magnetostrictive readout and also multiwire proportional counters are outlined. Advantages and disadvantages of both of these position-sensitive detectors are pointed out. Also, applications of spark chambers to fields other than high energy physics are discussed including medical use -- localizing gamma ray and positron emitters in the body; locating stopped negative pions; and neutron spectroscopy for recording double scattering events of neutrons on protons. NSA

N70-28992# California Univ., Berkeley. Lawrence Radiation Lab.
APPROXIMATE METHODS FOR CALCULATION OF INTRINSIC TOTAL-ABSORPTION AND DOUBLE-ESCAPE-PEAK EFFICIENCIES FOR GE(LI) DETECTORS
B. A. Euler and S. N. Kaplan Oct. 1969 10 p refs Presented at the 16th Nucl. Sci. Symp., San Francisco, 29-31 Oct. 1969
(Contract W-7405-eng-48)
(UCRL-19392; CONF-691017-9) Avail: CFSTI

Approximate methods are presented for calculation of intrinsic total-absorption and double-escape-peak efficiencies of Ge(Li) detectors. These methods utilize average characteristics of gamma ray photon interactions with matter, and, while developed for specific application to the Ge(Li) detector efficiency problem, should be applicable to any gamma ray detector or absorptive medium. The technique for total-absorption-peak efficiency determination includes the use of an average-photon energy-degradation curve and of the Dirac chord method for calculation of collision probabilities. Double-escape-peak efficiencies are determined through the calculation of the average probability of occurrence of the following three phenomena: (1) pair production, (2) electron-positron absorption, and (3) annihilation-photon double escape. Complete working curves and expressions are included to enable convenient utilization of these techniques. Example results are compared with efficiency determinations made experimentally and by Monte Carlo calculation. Author (NSA)

N70-29018*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LEAK DETECTOR FOR USE IN SPACE ENVIRONMENT
K. W. Woodis Washington Jun. 1970 30 p
(NASA-TN-D-5841; M-652L) Avail: CFSTI CSCL 14B

The design and manufacturing techniques and tests required to build a leak detector for aerospace hardware are presented. The basic configurations and power requirements are described in detail. It is shown that it is electronically, mechanically, and economically feasible to build leak detectors to support orbital inspection and checkout operations of large space stations and interplanetary vehicles. Author

N70-29137# MSA Research Corp., Evans City, Pa.
EFFECT OF HIGH-TEMPERATURE SODIUM ON THE MECHANICAL PROPERTIES OF CANDIDATE ALLOYS FOR

THE LMFBR PROGRAM: DEVELOPMENT OF A HIGH-TEMPERATURE EXTENSOMETER DEVICE FOR USE IN 1200 F LIQUID METAL SERVICE

Daniel A. Green and Earle C. King Jan. 1970 27 p *Its* Topical Report no. 17

(Contract AT(11-1)-765)

(MSAR-70-2) Avail: CFSTI

The design specifications, calibration, and testing of an extensometer for operation in liquid sodium at 1200 F are described. The extensometer employs a linear variable differential transformer located in the liquid sodium system. NSA

N70-29147# Argonne National Lab., Ill.

THE COMPLETE (ALPHA, BETA, GAMMA) PERSONNEL MONITOR

Richard W. Fergus Oct. 1969 18 p

(Contract W-31-109-eng-38)

(ANL-7616) Avail: CFSTI

A personnel hand and shoe monitor, PERCI (PERsonnel Contamination Instrumentation), has been developed to provide simultaneous detection of alpha, beta, and/or gamma contamination. Automatic operation provides uniform survey sensitivity that is independent of the user. Logic circuitry prevents incomplete surveys and causes go or no-go instructions to be flashed on an illuminated display panel. Alpha, beta, and/or gamma events for each channel are detected with a large-area, gas-flow detector and pulse-separation circuitry. A unique background compensation feature implements statistical computation for each survey by comparing the actual number of events during the survey cycle with a number predicted from the background events preceding the cycle. Reliable operation with stable calibration is assured with solid-state circuitry and appropriate feedback. Consistent performance with infrequent false alarms characterizes the operation of this monitor. Author (NSA)

N70-29166# Aerojet-General Corp., El Monte, Calif. Space Div.

DETERMINATION OF DIELECTRIC PROPERTIES OF NATURAL MATERIALS Technical Report, 16 Nov. 1967 – 15 Feb. 1970

Gene A. Poe Feb. 1970 94 p refs

(Contract Nonr-4767(00))

(AD-701362; SD-9016-5; TR-5) Avail: CFSTI CSCL 14/2

Over the period 16 November 1967 through 15 February 1970 significant laboratory studies of the dielectric properties of natural materials were performed. The methodology has been developed for making free-space measurements of the dielectric constant at microwave frequencies. Measurements of soils, water, salt water and ocean water have been performed and what are believed to be the major physical influences on the values of dielectric constant have been identified. The system used for the measurements is an ellipsometer, i.e., the receiving antenna measures the ellipticity and tilt angle of an elliptically polarized wave reflected from the materials surface. Intensive systematic error analyses have been performed and have identified and quantitized the principal error contributions to the dielectric constant values obtained. Author (TAB)

N70-29170*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

FIELD CALIBRATION OF THE RS-14 DUAL-CHANNEL AIRBORNE INFRARED IMAGER

Victor S. Whitehead Apr. 1970 23 p

(NASA-TM-X-58042) Avail: CFSTI CSCL 14B

The collection of data on the NASA Earth Resources Aircraft Program Mission 98 (Puerto Rico and Barbados) presented an opportunity to compare the output of the Barnes PRT-5 precision radiation thermometer and the RS-14 dual-channel airborne infrared imaging system aboard the NASA NP3A aircraft. The RS-14 as flown on Mission 98 was not a fully calibrated system. Inspection of the RS-14 output and comparison of the RS-14 data with the PRT-5 data suggest a simple calibration procedure for the RS-14. This calibration procedure indicates that very little error is introduced in the thermal channel because of the use of different parts of the optics during a scan and that the measured case temperature apparently is not a representative cavity temperature for the system. Author

N70-29191# Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.

DISCHARGE MEASUREMENTS USING THE RADIOISOTOPE VELOCITY, INTEGRATED SAMPLE, DILUTION, AND TOTAL-COUNT METHODS AT FLATIRON POWER AND PUMPING PLANT, COLORADO-BIG THOMPSON PROJECT

J. C. Schuster and R. L. Hanson Jul. 1969 39 p refs

(TID-25185) Avail: CFSTI

Radioisotope techniques and equipment are being developed to improve methods for measuring flow rate in high-heat turbines and pumps. A series of discharge measurements were made on a 6000-ft-long, 6-ft-dia penstock at a discharge of 300 cfs. Thirty-seven injections of radioactive bromine-82 were made for discharge measurements by the velocity method, 17 for the integrated-sample method, and 8 for the dilution method. These injections enabled computation of 33 discharges by the velocity method, 26 total-count method. A 4-point injection system, 45 deg from the vertical and horizontal center lines of the pipe, was used for most measurements. Mixing lengths ranged from 36 to 919 pipe diameters. Mixing lengths of 100 pipe diameters produced the same order of accuracy as mixing lengths of 919 diameters. Studies are continuing to increase measurement accuracy using pipe lengths as short as 30 pipe diameters. Author (NSA)

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N70-27816# Rutgers Univ., New Brunswick, N.J. School of Ceramics.

EVALUATION OF THE FUSION CASTING PROCESS FOR CERAMIC MATERIALS Final Report

William H. Bauer, Richard G. LaBar, Robert W. Matolka, and Joseph E. Palko 1 Sep. 1969 150 p refs

(Contract N00019-68-C-0268)

(AD-700392) Avail: CFSTI CSCL 13/8

Using Al2O3 as the study material, an evaluation of the fusion casting process for structural ceramic materials was conducted. The investigation into the improvement of structural soundness in castings of high alumina compositions included a study of furnace and mold design, melt conditions, chemical additions, vibrational casting, and heat extraction. Evaluation was made by microscopic observations, mechanical damping capacity measurements and strength testing. Structurally sound fused-cast alumina resulted from utilization of the most suitable system of process controls and furnace design in conjunction with optimum grain refinement and intergranular bonding, development of metastable solid solutions and strengthening by precipitation of solute rich phases. Author (TAB)

N70-27906# Naval Research Lab., Washington, D.C.

THE MECHANISM OF JOINT FORMATION IN SOLID-STATE WELDING OF ALUMINUM OXIDE CERAMICS WITH NIOBIUM [O MEKHANIZME OBRAZOVANIYA SOEDINENIYA PRI SVARKE V TVERDOM SOSTOYANII KERAMIKI IZ OKISI ALYUMINIYA S NIOBIEM]

E. S. Karakozov et al. 17 Feb. 1970. 14 p. refs. Transl. into ENGLISH from Fiz. Khim. Obrabotki Materialov (USSR), no. 3, 1968 p. 123-129
(AD-701547; NRL-Trans-1197) Avail: CFSTI CSCL 13/5

The kinetics of the process of joint formation in solid-state welding of Al2O3 ceramic to niobium was investigated. Calculations of the time of development of physical contact in welding Al2O3 and niobium, based on the conditions necessary to obtain a required creep rate, showed that total physical contact is formed with a temperature of 1500C, a pressure of 1.5 kg/sqmm and a time of 1000 sec. Thermodynamic calculations of the interaction of aluminum oxide with niobium pentoxide indicate the possible formation of a chemical bond at 1500C. The possibility of joining Al2O3 ceramic to niobium, using the calculated parameters, was proven by experiment. Author (TAB)

N70-27931# Defense Documentation Center, Alexandria, Va.
MANUFACTURING METHODS OF COMPOSITE MATERIALS, VOLUME 1. Bibliography Report, Apr. 1963 - May 1969
Feb. 1970. 69 p. refs
(AD-701500; DDC-TAS-70-1-Vol-1) Avail: CFSTI CSCL 11/4

The annotated bibliography contains unclassified and unlimited references on Manufacturing Methods of Composite Materials such as fabrication techniques and fiber forming. Author (TAB)

N70-27932# Naval Civil Engineering Lab., Port Hueneme, Calif.
HIGH-EXPLOSIVE FIELD TEST OF HIGH-CAPACITY BLAST VALVE. Technical Report, Oct. 1967 - Feb. 1969
D. E. Williams and R. S. Chapler. Feb. 1970. 36 p. refs
(AD-702039; NCEL-TR-659) Avail: CFSTI CSCL 13/11

The Naval Civil Engineering Laboratory has developed and tested a series of experimental valves varying in capacity from 700 cfm to 10,000 cfm, with 1 inch of water-flow resistance. A 2,500-cfm valve evolved after a series of tests with the 700-cfm buckling plate valve. Although the configuration of the larger valve differed from its predecessor, the concept remained essentially unchanged. Designed criteria for a high-capacity valve were established after experimental confirmation of the concept. Based upon such criteria, a 10,000-cfm valve, which consisted of four 2,500-cfm valves in a parallel arrangement within the same housing, was designed and fabricated. The valve was field tested in the 100-psi overpressure range at Operation PRAIRIE FLAT in Canada, with excellent results. The valve closed in 15 msec without damage from the external environment. Author (TAB)

N70-28034# Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.
DYNAMICS SIDE STUDY FOR THE LOW-CAPACITY SODIUM PUMP
T. L. Geiger. May 1969. 79 p. refs
(Contract AT(30-1)-3762)
(WARD-3762-7) Avail: CFSTI

More than 200 centrifugal pump shafts were designed and analyzed for critical speed to assess their value as a primary sodium pump. Supporting members, including the pump motor, all bearings, support structure, and pump tank were analyzed for their contributions to the dynamic response of the pump system. Shaft lengths of 24 feet, 30 feet and 40 feet were considered operating at speeds of 900 rpm, 1050 rpm, and 1150 rpm. At 1150 rpm, two 24-foot shaft systems were found to be superior from the standpoint of cost and reliability. Author (NSA)

N70-28041# Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.
DRIVE STUDY FOR THE LOW-CAPACITY SODIUM PUMP
R. F. Edwards and R. M. Matsko. Apr. 1969. 34 p. refs
(Contract AT(30-1)-3762)
(WARD-3762-6) Avail: CFSTI

Data on the initial and operating costs, the advantages and disadvantages, and the reliability of several liquid-metal pump drive systems that are capable of providing an adjustable speed range of up to 10:1 are presented. The systems investigated were: wound rotor induction motor with a liquid rheostat and a liquid cooled brake, or a liquid rheostat and an air cooled generator brake, or a solid state static frequency converter; a direct current motor with a solid state power supply; and motors with electric couplings including a synchronous motor with an electric coupling and a squirrel-cage induction motor with an electric coupling. A system that employs a wound rotor induction motor with a liquid rheostat and air cooled generator brake is recommended. This recommendation is based upon equipment cost and proven degree of reliability. Author (NSA)

N70-28092*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A VERSATILE, LOW COST, FABRICATION TECHNIQUE FOR FLIGHT HARDWARE
H. Chernikoff, M. Tharpe, and L. Pack. Jul. 1969. 45 p.
(NASA-TM-X-63915; X-562-69-286) Avail: CFSTI CSCL 09C

A flight hardware packaging technique used in the assembly of the auxiliary command memory unit for the OAO-B spacecraft is described. The technique is a departure from the use of printed circuits and has met all the stringent demands required in the assembly of space hardware. Author

N70-28106# Naval Ship Systems Command, Washington, D.C. Scientific Documentation Div.
CARRYING CAPACITY OF SLIDING BEARINGS WITH FLOATING ELEMENTS LOADED BY A VARIABLE DIRECTION FORCE [NESUSHAYA SPOSOBNOST PODSHIPNIKOV SKOLZENYA S PLAVAYOSHIMI ELEMENTAMI PRY NAGRUZENYE SYLOY PEREMENNOGO NAPRAVLENYA]
A. G. Burgvitz et al. Mar. 1970. 7 p. refs. Transl. into ENGLISH from Russian report
(AD-702251; NAVSHIPS-TRANS-1223) Avail: CFSTI CSCL 13/9

The paper investigates the carrying capacity of several types of sliding bearings subjected to a rotating force. An inversion method was used which consisted of solving the basic equations within the coordinate system related to the line of action of the load. It was determined that bearings with floating elements have superior load carrying capacity compared to more conventional type bearings without floating elements. Author (TAB)

N70-28216+ Laboratorio de Acustica e Sonica, Sao Paulo (Brazil).
ULTRASONIC INSPECTION AND CHEMICAL ANALYSIS OF FORGED STEEL PARTS [INSPECAO ULTRA-SONICA DE PECAS FORJAOAS, ANALISE QUIMICA DO MATERIAL]
H. Onusic, E. J. Cury, and Y. M. Alessio. 27 Aug. 1969. 12 p. In PORTUGUESE; ENGLISH summary
(TN-6908-382) Avail: CFSTI

The inspected part, the procedure, and equipment used for the ultrasonic inspection of forged steel parts are described. The ASTM A-388/67 acceptance criteria were chosen. The results are presented in schematic drawing form, with defect positioning and photographs of the observed echograms. The chemical analysis is given with microphotographs of the material, showing the texture. Author

N70-28217+ Laboratorio de Acustica e Sonica, Sao Paulo (Brazil)
ULTRASONIC INSPECTION OF WELDING IN THE FORCED DUCTS IN CAPIVARI-CACHOEIRA HYDROELECTRIC POWER PLANT (ELETROCAP) [INSPECAO ULTRA-SONICA DE SOLDAGEM DO DUTO FORCADO DA USINA

HIDROELETRICA DE CAPIVARI-CACHOEIRA/ELETROCAP]
H. Onusic and E. J. Cury 25 Nov. 1969 5 p In PORTUGUESE; ENGLISH summary
(TN-6911-393) Avail: CFSTI

The ultrasonic inspection procedure, the inspected welding, acceptance criteria, and equipment specifications are described. Interpretations of echograms are also given. Author

N70-28225 + Laboratorio de Acustica e Sonica, Sao Paulo (Brazil)
ULTRASONIC INSPECTION FOR EVALUATION OF THE BOND BETWEEN THE BABBIT AND THE BASE METAL [INSPECAO ULTRA-SONICA DE MANCAIS DE MOTOR DIESEL PARA VERIFICACAO DE ADERENCIA]
H. Onusic and M. F. Barbosa [1969] 7 p refs In PORTUGUESE; ENGLISH summary
(TN-6911-394) Avail: CFSTI

As a basis for evaluating the bonding between the babbit and the base metal, details are given on the procedure, equipment, and accessories used in the ultrasonic inspection of a series of large metallic bearings. The results are presented in graphic form, including photos of the observed echograms. Author

N70-28247*# Martin Marietta Corp., Denver, Colo.
A MECHANICAL FASTENING TECHNIQUE DEVELOPMENT FOR APPLICATION IN SPACE Final Report
Floyd K. Daisey and Don A. Lewis 31 Mar. 1970 109 p refs
(Contract NAS8-21253)
(NASA-CR-102670; MCR-69-410) Avail: CFSTI CSCL 13E

A study effort to investigate a threaded mechanical fastening technique for use in zero or reduced gravity space environments is described. The program consisted of four phases of effort: (1) state of the Art Survey; (2) selection and development; (3) evaluation and testing; and (4) definition and evaluation of environmental effects on joints and fasteners. The data gathered and formulated during the various phases of the program are detailed. Author

N70-28297# Naval Research Lab., Washington, D.C.
OCEAN TECHNOLOGY: PROBLEM NOTES
In its Rept. of NRL Progr. Mar. 1970 p 41 (See N70-28291 14-34)
Avail: CFSTI

The 12Ni-5Cr-3Mo maraging steel was found to maintain good toughness at the intermediate-to-high strength level. The study was concerned with fabricating and optimizing weld joints in the 12-5-3 maraging steel. Three weld-wire compositions, two TIG welding processes, and two heat-treating sequences were compared in all possible combinations. Welds and weld repairs were compared in tensile, impact, fracture-toughness, and metallographic evaluations. Various comparisons are presented in tables and graphs. These data show that the slightly increased yield strength obtained through the TIG welding process is more than offset by the reduced toughness. Author

N70-28541*# Bendix Corp., Teterboro, N.J. Navigation and Control Div.
DEVELOPMENT OF IMPROVED PERFORMANCE HIGH SPEED SPIN BEARING AND GYRO WHEEL PROGRAM Final Report
A. Carriero and L. Caravetta May 1969 123 p
(Contract NAS8-11356)
(NASA-CR-102618) Avail: CFSTI CSCL 13I

The task requirements of the High Speed Bearing and Gyro Wheel Evaluation program are summarized. The results from life testing and gyro performance testing for all of the various bearing assemblies, lubricants and mortors assembled are presented with conclusions and recommendations. Author

N70-28690*# Thiokol Chemical Corp., Elkton, Md.
DESIGN AND TESTING OF SQUIB-ACTUATED VALVE Final Report
H. G. Jones 8 May 1970 45 p Prepared for JPL
(Contract NAS7-100; JPL Order FK-505624)
(NASA-CR-110149; E110-70) Avail: CFSTI CSCL 13K

The following conclusions were reached after evaluating the test data: the normally closed prototype valve can be actuated with the supplied squib. The actuated Rolldex assembly of the normally closed prototype valve provides a hermetic seal between the pressure cartridge combustion products and working fluid. The tests conducted on the prototype valve verify the analytically established operational margins and performance. Author

N70-28705# Joint Publications Research Service, Washington, D.C.
THREE WELDING METHODS TESTED IN SPACE
V. B. Dmitriyev 4 Jun. 1970 9 p ref Transl. into ENGLISH from Khim. i Zhizn. (USSR), no. 2, 1970 p 17-20
(JPRS-50658) Avail: CFSTI

Automatic space welding experiments were conducted with the Vulcan space welding device on board the Soyez-6 spacecraft, 16 October 1969. The three methods tested were electron beam, consumable electrode, and compressed arc welding. Author

N70-28726*# General Electric Co., Philadelphia, Pa. Space Sciences Lab.
INVESTIGATION OF THE PREPARATION OF MATERIALS IN SPACE. TASK 4: FIELD MANAGEMENT FOR WEIGHTLESS CONTAINERLESS PROCESSING Quarterly Progress Report, 22 Aug.-31 Oct. 1969
R. T. Frost, A. Gatti, H. Halsey, L. Mc Creight, L. Napalkoh, et al
15 Nov. 1969 68 p refs
(Contract NAS8-24683)
(NASA-CR-102672; QPR-2) Avail: CFSTI CSCL 13H

The theory of electromagnetic position control for a freely floating, conducting sphere and the implementation of initial experiments on position control was reviewed and extended. Techniques were developed for measurement of small forces on conducting spheres suspended alternately on a long pendulum or freely rolling on a precision glass tilt table. Force measurements under a variety of conditions were compared with theory. Stability of the suspended mass in two dimensions was demonstrated without the use of position sensing or control. An electronic servo was designed, constructed and demonstrated to be capable of high accuracy position sensing for rapid damping of position and position rate errors. Some work was begun on general considerations to study the range of applicability for electromagnetic or electrostatic positioning of materials having a wide range of properties. Work was also begun to define associated hydrodynamic problems concerned with creation or damping of shape oscillations and generation of fluid currents for mixing or shape control. Author

N70-28811# California Univ., Livermore. Lawrence Radiation Lab.
REMOTELY OPERATED CATHODIC ETCHER
J. C. Garrison, J. M. Johnson, and E. D. Albracht 27 Jun. 1969 12 p refs Presented at the 17th Conf. on Remote Systems Technol., San Francisco, 30 Nov.-5 Dec. 1969 Sponsored by AEC
(UCRL-71559; CONF-691102-18) Avail: CFSTI

A production-type cathodic etcher has been redesigned for hot cell application. Extensive changes were made in the electrical insulation of components of the etching assembly to virtually eliminate arcing during etching. The etching assembly was unitized to provide for rapid remote insertion of specimens by master-slave manipulators. Periodic remote disassembly was simplified through design modifications which allowed for two finger manipulation. Vacuum and argon pressure valves were electrically

actuated for remote operation, and safety interlocks were installed between the vacuum and electrical systems. Author (NSA)

N70-28823# Sandia Corp., Livermore, Calif. Materials Div.
SEPARATING LARGE THIN ELECTROFORMED PARTS FROM MANDRELS
J. W. Dini and H. R. Johnson Feb. 1970 19 p refs
(Contract AT(29-1)-789)
(SCL-DR-69-165) Avail: CFSTI

A separation process is described for fabricating large, thin walled electroformed parts. The process involves a special parting medium and surface preparation of the mandrel. Author

N70-28848# Mound Lab., Miamisburg, Ohio.
ULTRASONIC JOINING OF FINE WIRES
M. A. Richards 12 Feb. 1970 22 p
(Contract AT(33-1)-GEN-53)
(MLM-1663) Avail: CFSTI

Ultrasonic welding of small diameter (<0.005 cm), gold wires to copper wires molded in plastic was investigated. The most apparent variables that affect weld quality are normal force of the welding tip on the material or part to be welded, welding tip displacement, and duration of the ultrasonic vibration. Less obvious variables affecting weld quality were found and are listed in decreasing order of their influence on weld quality: (1) rigidity of the welding tip retaining fixture, (2) impact transients on the welding tip, (3) angle of the welding tip to the material or part to be welded, (4) electrical transients in the driving signal to the ultrasonic transducer, and (5) interfacials surface finish of the parts to be welded. Results indicated that ultrasonic welding of small diameter, gold wire is feasible provided that: the variables affecting weld quality are closely controlled, the wire and substrate hardness are nearly equivalent, and no impenetrable films, metallic oxides, or crusts are on the surfaces of the parts to be welded. Author

N70-28893# Bendix Corp., Kansas City, Mo.
LEAD WIRE SOLDERABILITY TEST
W. W. Turner [1969] 8 p
(BDX-613-128) Avail: CFSTI

A test developed to determine easily the solderability of lead wires such as stranded or solid interconnect wires and component leads is described. It is based on the measurement of the contact angle between a test sample and a droplet of solder wicked onto the end of the sample. Results indicate that the accuracy and sensitivity is adequate for determining most solderable-unsolderable margins. The test applies not only to the development of soldering processes, but also to monitoring the solderability of material during manufacture. Author (NSA)

N70-28902# Royal Aircraft Establishment, Farnborough (England).
THE EFFECT OF GROOVE-EDGE SHARPNESS IN RAYLEIGH STEP-BEARINGS (COMPRESSIBLE FLOW)
E. U. Trevorrow Sep. 1969 21 p refs
(RAE-TR-69192) Copyright. Avail: CFSTI

The performances of some bearings with various amounts of step degeneration have been tabulated and compared with the performances of bearings with perfect steps for compressible flow. In general, performance is only slightly affected by step degeneration. Author (ESRO)

N70-28922*# Camin Labs., Inc., Brooklyn, N.Y.
DEVELOPMENT OF ADVANCED FABRICATION TECHNIQUES FOR REGENERATIVELY COOLED THRUST CHAMBERS BY THE ELECTROFORMING PROCESS Final Report
S. Hammer and Z. Czacka 1 Oct. 1969 142 p refs
(Contract NAS3-10304)
(NASA-CR-72698) Avail: NASA Scientific and Technical Information Facility, P.O. Box 33, College Park, Md. 20740 Avail: 17H

Processes were developed for the fabrication of regenerative type chambers containing Hastelloy X, Inconel 718, TD nickel, sprayed zirconia and sprayed zirconia-nichrome inner walls backed by electroformed nickel ribs and outer shells. In addition procedures were developed for fabricating inner walls from wire or ribbon that is wrapped on a mandrel and supported by the electroformed rib and outer jacket. All of the above configurations were demonstrated to be feasible. In addition the ability to reinforce the outer electroformed shell with intermediate wire windings was also demonstrated. The two most promising configurations: Hastelloy X and graded coating inner walls were selected for further evaluation. Two spool pieces, for use with hydrogen-oxygen propellants at a chamber pressure of 500 psia and 30,000 lbf thrust, were designed and fabricated. One unit contained a Hastelloy X inner wall, while the second unit contained the graded zirconia-nichrome coating. Rocket firings were conducted at NASA Lewis Research Center with each of the spool pieces. Both units met all design requirements. Author

N70-28982# Brookhaven National Lab., Upton, N.Y.
COMPACT SERVO MASTER-SLAVE MANIPULATOR WITH OPTIMIZED COMMUNICATION LINKS
Carl R. Flatau [1969] 28 p Presented at the 17th Conf. on Remote Systems Technol. San Francisco Sponsored by AEC
(BNL-13810; CONF-691102-22) Avail: CFSTI

A compact, bilateral force reflective servo manipulator has been developed for use in the confined environment of high energy particle accelerators. The compactness is achieved by placing the dc servo motors and all other servo components within the manipulator arms. By use of explicit force feedback in addition to the customary position feedback, reflected friction is reduced so that sensitivity and feel are improved. Potential slave-to-master distance and slave mobility are improved by optimization of communication links. These are reduced to 15 channels per manipulator arm. Author (NSA)

N70-29143# Bendix Corp., Kansas City, Mo.
DEVELOPMENT OF INSTRUMENTATION FOR RELIABLE PERCUSSIVE ARC WELDING SYSTEMS
I. V. Patterson [1969] 11 p Presented at Instr. Soc. of Am. Symp., Albuquerque, N.Mex.
(Contract AT(29-1)-613)
(BDX-613-129; Conf-700104-1) Avail: CFSTI

The percussive arc welding process and the problems associated with production techniques are described. The development of a system as related to ultra-reliable product requirements is discussed. Author

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N70-27920# Stanford Research Inst., Menlo Park, Calif.
RESEARCH ON OCULAR LASER THRESHOLDS Final Report, 15 Mar. 1968 – 15 Jul. 1969
Arthur Vassiliades, Robert C. Rosan, and H. Cristian Zweng Aug. 1969 88 p refs
(Contract F41609-68-C-0041)
(AD-700422) Avail: CFSTI CSCL 6/19

Results of experimental investigations of threshold levels for small retinal lesions are presented. Data for rhesus monkeys include thresholds for a Q-switched neodymium laser, both in the macula and in the paramacular area. In addition, extensive data are presented for argon, helium-neon, and neodymium-YAG laser damage threshold. Exposures of human volunteers to various lasers are reported. The lasers used were Q-switched neodymium and

ruby lasers, a long-pulse ruby laser, and an argon laser. A report on the histopathology of retinal injury in rhesus monkeys due to Q-switched neodymium and argon lasers is included. Author (TAB)

N70-27941*# Alabama Univ., University. Bureau of Engineering Research.
STUDY OF ATMOSPHERIC EFFECTS ON OPTICAL COMMUNICATIONS AND OPTICAL SYSTEMS Final Report
William E. Webb Nov. 1969 97 p refs
(Contract NAS8-30507)
(NASA-CR-102680; BER-111-70) Avail: CFSTI CSCL 20E

A theoretical study of the tracking errors induced in an optical radar by atmospheric turbulence is discussed. Expressions for the magnitude of atmospherically induced angle of arrival fluctuations have been derived. These expressions have been compared with the available experimental data and found to agree within the experimental accuracy. A tracking system using multiple receivers which would reduce the apparent angle of arrival fluctuations without requiring large receiving apertures is proposed. The scintillation of a 10.6 micron laser beam and the signal-to-noise ratio in a frequency modulated CO2 laser communications system is discussed. Techniques for reducing the subject data have been developed and software generated to implement the analysis on the IBM system 360-50 computer. Author

N70-28006*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PROPOSAL FOR ADVANCED LASER PROPAGATION EXPERIMENTS BETWEEN STABILIZED SYNCHRONOUS SATELLITES AND GROUND STATIONS, AT VISIBLE AND NEAR-INFRARED WAVELENGTHS
Erwin Hirschmann Apr. 1970 59 p refs
(NASA-TM-X-63918; X-733-70-119) Avail: CFSTI CSCL 20E

Proposed laser experiments which are to be flown on board synchronous satellites are discussed. Wavelengths of 1.06 micron(near-infrared)and 0.53 micron (optical) will be used in these experiments, which will consist of measurements of the laser propagation characteristics from ground-to-spacecraft, and measurements of the spacecraft range. Laser transmitters carried in the satellite may later permit measurements of the spacecraft-to-ground propagation characteristics. Laser transmitters and receivers are discussed, and attenuation of the signal by various meteorological phenomena is considered. Author

N70-28124*# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
OPTIMAL SPATIAL MODULATION FOR RECIPROCAL CHANNELS
Jeffrey H. Shapiro 30 Apr. 1970 128 p refs
(Grant NGL-22-009-013; DA-28-043-AMC-02536(E))
(NASA-CR-109890; TR-476) Avail: CFSTI CSCL 20E

Ways to improve optical communication through atmospheric turbulence by using spatial modulation were investigated. The performance of a class of adaptive spatially modulated communication systems, in which the antenna pattern at the transmitter is modified in accordance with the knowledge of the channel state obtained from a beacon signal transmitted from the receiving terminal to the transmitter, is examined. For time-invariant channels satisfying a certain reciprocity condition, there exists an adaptive system that achieves the maximum energy transfer possible from transmitter to receiver. This result is applied to the turbulent atmospheric channel by regarding the atmosphere as undergoing a succession of fixed states, and proving that instantaneously the atmosphere is reciprocal. The performance of adaptive spatially modulated systems for the turbulent channel is derived for both point-to-point and deep-space applications. In the deep-space case we find that the turbulence does not increase the average far-field beamwidth attainable with a given diameter aperture, but fluctuations about this average beamwidth do occur as the state of the atmosphere changes. The effects of noise and approximate transmitter implementations on the performance of the adaptive systems under discussion are considered. A hypothetical deep-space system is specified and its performance is evaluated. Author

N70-28201*# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electroncs.
EFFICIENT OPTICAL COMMUNICATION IN A TURBULENT ATMOSPHERE
Seppo J. Halme 1 Apr. 1970 122 p refs
(Grant NGL-22-009-013; DA-28-043-AMC-02536(E))
(NASA-CR-109889; TR-474) Avail: CFSTI CSCL 20E

Given a transmitter that radiates an electromagnetic light field, it is assumed that the resulting field at the plane of the receiver aperture is log-normal with some coherence properties. Various representations of the field are discussed; aperture sampling, plane-wave decomposition, and Karhunen - Loeve expension. The statistical properties of the coefficients in these representations are investigated by analytical, simulation, and experimental methods. Based on these representations the problem of optimum detection of an orthogonal signal set, subject to distortion and noise in the atmosphere, is investigated. The optimum receiver and its performance are evaluated and discussed in the cases of log-normal and Gaussian statistics, classical and quantum models, large and small apertures, and strong, weak or absent background noise. Author

N70-28271 Brandeis Univ., Waltham, Mass.
THE ELECTROMAGNETIC FIELD AND LASER DYNAMICS IN A CAVITY BOUNDED BY MOVING MIRRORS
Gerald Tracy Moore (Ph.D. Thesis) 1969 125 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 69-20731

The propagation of linearly polarized light in a one-dimensional cavity bounded by moving mirrors is studied in the context of the theory of gas lasers. The mirrors are represented by applying vanishing boundary conditions to the Coulomb-gauge vector potential A along the mirror trajectories. By using the method of images, a geometrical solution for the free propagator is found, and its antisymmetry and canonical equal-time properties are demonstrated. The existence of a conserved antisymmetric bilinear form in the space S of classical free-field solutions gives S a natural symplectic structure, which is investigated by using a symplectic analog of Dirac notation. A canonical quantization of the free field and a definition of the field operator are made by means of a linear mapping from S to a space of Hermitean operators which act in the Hilbert space of physical states. Dissert. Abstr.

N70-28292# Naval Research Lab., Washington, D.C. Quantum Optics Branch.
RESEARCH IN NONLINEAR OPTICS
Herbert Rabin *In its* Rept. of NRL Progr. Mar. 1970 p 1-23 refs (See N70-28291 14-34)
Avail: CFSTI

The propagation of laser radiation through matter cannot be described by the familiar (linear) laws of optics. The inclusion of quadratic and cubic terms in the polarization of a medium are necessary to account for a variety of new nonlinear effects at optical frequencies. Studies are discussed in the exemplification of these nonlinear phenomena. Author

N70-28315# Frankford Arsenal, Philadelphia, Pa.
DETERMINATION OF VISIBLE THRESHOLD OF DAMAGE IN RETINA OF RHESUS MONKEY BY Q-SWITCHED RUBY LASER
Maurice B. Landers, Edwin S. Beatrice, Harold H. Byer, James O. Powell, Jack E. Chester et al Oct. 1969 17 p refs
(AD-700124; FA-M69-28-1) Avail: CFSTI CSCL 6/18

Ruby laser threshold damage data have been previously reported. Results indicate at least one order of magnitude difference in reported values. This paper reevaluates the threshold data in 20 eyes of rhesus monkeys from Q-switched ruby laser exposures in the range from one to 100 microjoules, with results described in terms of total energy delivered to the eye. The apparatus employed differed from that of previous investigators by the use of a TEMoo mode ruby laser in preference to a multimode laser. Author (TAB)

N70-28491# California Univ., Livermore. Lawrence Radiation Lab.
HEATING OF MATERIAL NEAR THE SURFACE OF A SOLID BY LASER IRRADIATION [NAGREVANIE VESCHESTVA VBLIZI POVERKHNOSTI TVERDOGO TELA ISLUCHENIEM LAZERA]
Yu. V. Afanasev et al Sep. 1969 9 p refs Transl. into ENGLISH from the Russian
(PB-187239T; UCRL-Trans-10379) Avail: CFSTI CSCL 20M

The problem of the heating that develops near the surface of a solid irradiated by a laser is examined. Self-simulating equations are derived, and an asymptotic solution is found. A close approximation of the gas dynamic variables was obtained. Author (USGRDR)

N70-28540*# Sylvania Electronic Systems-West, Mountain View, Calif. Research and Development Dept.
FREQUENCY STABILIZED GAS LASER Final Report
Michael W. Sasnett 1 Oct. 1969 81 p refs
(Contract NAS8-20631)
(NASA-CR-102617) Avail: CFSTI CSCL 20E

This report presents details of the design, construction and test of a stabilized CO2 laser heterodyne communication system operating at 10.59 microns. Calculations show that the expected heterodyne signal-to-noise ratio for a 4 km atmospheric path is approximately 63 dB. Two-megahertz-bandwidth phase modulation of the 1-watt transmitter laser with a modulation depth of 0.22 is provided by an electro-optic GaAs phase modulator. Transmitting and receiving antennae are 4 1/4 inch diameter f/4.5 Newtonian telescopes. Local oscillator and signal beams are mixed on a Ge:Au detector to provide a 10 MHz i.f. which is maintained by an AFC loop which keeps the local oscillator laser's frequency offset from the transmitter laser by 10 MHz. Spectrum analysis of the unmodulated i.f. signal shows a characteristic linewidth of about 6 kHz with slow drifting of the i.f. within + or - kHz. Detection of the phase information after amplification of the i.f. is by means of an FM discriminator followed by a broadband integrator. Measurements of system performance over a short indoor propagation path showed a large noise component at low frequencies, due to phase instability between laser oscillators. This noise was suppressed by limiting of system response at low audio frequencies. Suppression of modulator resonances is discussed. A method for relatively easy conversion of the system to AM transmission is described. Such a conversion will allow comparative evaluation of the two types of systems. Author

N70-28676*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SENSITIVITY OF EXPLOSIVES TO LASER ENERGY
Vincent J. Menichelli and L. C. Yang 30 Apr. 1970 29 p refs
(Contract NAS7-100)
(NASA-CR-110133; JPL-TR-32-1474) Avail: CFSTI CSCL 20E

A study has been made to determine the practicability of initiating some common explosives with laser energy. Pulsed ruby and neodymium lasers, in the free-running mode, were the source of energy. The laser pulse was adjusted for 5 J output and externally attenuated. The explosive materials were pressed prior to testing. Primary high explosives and some metal/metal oxide mixtures were easily initiated. However, secondary high explosives were not initiated at the 5-J level under the conditions reported. Reflectivity of the sample surface is of considerable importance to initiation. The relative sensitivity ordering of the explosives tested conformed quite well to the ordering one would expect from other methods of sensitivity testing, i.e., friction, impact, etc., provided that the sensitivity value is adjusted for reflective losses. Author

N70-28752*# Atlantic Research Corp., Alexandria, Va. Kinetics and Combustion Group.
THE LASER-INDUCED COMBUSTION OF PURE AMMONIUM PERCHLORATE AND THE STRUCTURE OF ITS COMPOSITE PROPELLANT FLAMES Annual Report, 16 Nov. 1968 - 15 Nov. 1969
Martin Hertzberg 15 Nov. 1969 40 p refs
(Contract NAS1-8767)
(NASA-CR-66919) Avail: CFSTI CSCL 20E

The results are described of a newly developed experimental method for studying the combustion behavior of heterogeneous solid propellants. The method uses a carbon dioxide laser beam to sustain low pressure combustion from a laminarized propellant consisting of AP/fuel/AP sandwiches of millimeter slab thickness. The significant flame dimensions are expanded in size so that the flame structure is readily probed. New data are presented for the compositional, thermal, and flow structure of the flames. These data are interpreted in the frame work of a classical wave model for the laminar combustion of a homogeneous, premixed gaseous flame, which is expanded and applied to the heterogeneous combustion of a pure solid monopropellant. A solution to the conservation equation is obtained by relating the gas phase heating rate above the propellant surface to the burning velocity of the pyrolysis gases. The solution yields regression rate predictions that are in good agreement with the data for pure AP and for several other pure monopropellants. The theory was modified to include nonadiabatic effects such as externally applied laser radiation. Author

N70-28789*# Maryland Univ., College Park, Md. Dept. of Physics and Astronomy.
THE DETECTOR PACKAGE FOR THE LASER RANGING EXPERIMENT AT McDONALD OBSERVATORY: ITS DESIGN, PERFORMANCE AND OPERATION
S. K. Poultney 14 Aug. 1969 97 p refs
(Grant NGR-21-002-109)
(NASA-CR-110217; TR-957) Avail: CFSTI CSCL 20E

The detector package for spectral and spatial filtering for the ranger lunar probes is described. Spectral filters with 3 and 0.7 A passbands and 35 and 55 percent transmissions are emphasized. Beam splitting and quantum efficiency enhancement, PMT mounts and shielding, and receiver efficiency are reviewed, as well as dark current, lunar background, and star measurements. Light-tightness and shutter of the detector package in light and and heat baffles are also considered. J.A.M.

N70-28791*# Maryland Univ., College Park. Dept. of Physics and Astronomy.
REPORT ON DECEMBER 1969 PERFORMANCE AND CALIBRATION TRIP TO THE LUNAR LASER RANGING STATION AT McDONALD OBSERVATORY
S. K. Poultney Jan. 1970 25 p refs
(Grant NGR-21-002-109)
(NASA-CR-110208; TR-70-075) Avail: CFSTI CSCL 20E

Performance of the detector package, Korad laser, receiver efficiency, and other portions of the laser ranging station during December 1969 is reported. A summary of start and stop line delay calibration is also included. Author

N70-28792*# Maryland Univ., College Park. Dept. of Physics and Astronomy.
REPORT ON JANUARY 1970 PERFORMANCE AND CALIBRATION TRIP TO THE LUNAR LASER RANGING STATION AT McDONALD OBSERVATORY

S. K. Poultney 2 Mar. 1970 28 p refs Submitted for publication
(Grant NGR-21-002-109)
(NASA-CR-110205; TR-70-087) Avail: CFSTI CSCL 20E

Performance of the detector package, Korad laser, receiver efficiency, and other portions of the laser ranging station is reported. A summary of start and stop line delay calibration is also included along with the results of the calibration procedure. Author

N70-28825# Sandia Corp., Albuquerque, N.Mex. Technical Translation Service.

ANGULAR DISTRIBUTION OF A SUBSTANCE HAVING BEEN VAPORIZED BY A LASER BEAM [UGLOVOE RASPREDELENIE VESHCHESTVA ISPARENNOGO LUCHOM OKG]

Yu. Bykovskii et al 24 Feb. 1970 6 p refs Transl. into ENGLISH from Zh. Eksperim. i Teor. Fiz. (Moscow), v. 56, no. 6, 1969 p 1819–1822
(SC-T-70-4007) Avail: CFSTI

The angular distribution of a substance vaporized by a laser beam, operating in regimes of a free generation and a modulated quality, is investigated. Beta-active T1-204 was utilized as a target. It was assumed that the angular distribution in the regime of a modulated quality is determined basically by the departure of tiny fragments or debris after the impact of a shock wave. Theoretical evaluations were adduced which harmonize with the experimental results. Author

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N70-27824# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

BEHAVIOR OF STAINLESS STEELS IN SODIUM AT TEMPERATURES BETWEEN 600–900 C

N. P. Agapova et al 1 Nov. 1969 20 p refs Transl. into ENGLISH from Proceedings of Symp. on Alkali Metal Coolants—Intern. Atomic Energy Agency (Vienna), 1967 p 85–96
(AD-702288; FTD-MT-24-278-69) Avail: CFSTI CSCL 11/6

The interaction of steel with a molten sodium flow has been studied in experimental loops with forced coolant circulation. During a first stage of the work, the behaviour in sodium of the basic components of steel - iron, nickel and chromium - was studied. The tests showed that nickel reacts particularly sharply to any change in (experimental) conditions: its stability is markedly affected by increases in temperature and sodium velocity. The manner in which variations of the iron, nickel and chromium balance can affect the stability of different steels and alloys is considered. It is shown that changes in the chromium content (from 12 to 20 wt. percent) have little effect on the stability of steels (with constant nickel content of 15 wt. percent), but that the stability depends basically on the ratio of iron to nickel: high nickel steels behave in sodium much as unalloyed iron. The effect on steel stability of alloying with certain other elements (e.g. C, N, Mn, Si, Nb, Ti, Mo, W) has also been studied. Author (TAB)

N70-27825# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INVESTIGATION OF WEAR RESISTANCE OF ALUMINUM ALLOYS V95, VAD23 AND D16

O. Ye. Kestner et al 24 Oct. 1969 11 p ref Transl. into ENGLISH from Alum. Splavy (USSR), no. 5, 1968 p 176–180
(AD-702289; FTD-MT-24-282-69) Avail: CFSTI CSCL 11/6

In some domains of technology it has become necessary to use aluminum alloys as the materials of parts of gear and friction drives (gearings, cams, etc.) which must meet high requirements for wear resistance and precision dimensioning. Analysis shows that the most suitable alloys for this purpose are the alloys V95, VAD23 and D16 provided that they are subjected to the following regimes of heat treatment to assure satisfactory dimensional stability and mechanical properties: (a) V95, quenching from 470 plus or minus 5 degrees centigrade, cooling in 80 degrees centigrade water, aging at 140 plus or minus 5 degrees centigrade for 16 hr; (b) D16, quenching from 500 plus or minus 5 degrees centigrade, cooling in 80 degrees centigrade water, aging at 190 plus or minus 5 degrees centigrade for 12 hr; (c) VAD23, quenching from 525 plus or minus 5 degrees centigrade, cooling in 20 degrees centigrade water, aging at 190 plus or minus 5 degrees centigrade for 12 hr. Accordingly, following this heat treatment, specimens of the above alloys were subjected to wear tests in Kh-2 and Amsler friction machines. These tests showed that the maximum wear resistance is displayed by the alloy V95 when hardened by means of heat treatment to a Brinell hardness of 150-180 kg/sq mm. Author (TAB)

N70-27837# Naval Civil Engineering Lab., Port Hueneme, Calif.

FIELD TESTING OF ELECTRICAL GROUNDING RODS Final Report, Jul. 1962–Jul. 1969

Richard W. Drisko and A. E. Hanna Feb. 1970 66 p refs
(AD-702040; NCEL-TR-660) Avail: CFSTI CSCL 9/1

A 7-year program of field testing metal rods for electrical grounding was conducted. Single rods of galvanized steel, copper-clad steel, Ni-Resist cast iron, type 302 stainless steel, type 304 stainless-clad steel, zinc, magnesium, and aluminum were tested along with couples of these to mild steel rods. Sets of both single and coupled rods were removed, cleaned, and weighed after 1, 3, and 7 (or 5) years. Potential, resistance, and current measurements were made monthly as far as practicable. Weight losses and electrical data were analyzed for correlations. It was concluded that type 302 stainless steel and type 304 stainless-clad steel rods were the best choices for general use. Author (TAB)

N70-27866# Dow Chemical Co., Golden, Colo. Rocky Flats Div.

PREPARATION OF RADIOCHEMICALLY PURE NEPTUNIUM METAL FOILS

William V. Conner and Donald L. Basso 30 Dec. 1969 6 p refs
(Contract AT(29-1)-1106)
(RFP-1415) Avail: CFSTI

Radiochemically pure neptunium metal was prepared for fabrication into thin metal foils. The neptunium purification was accomplished using nitrate and chloride anion exchange techniques. The procedure used removed all nuclides that emit gamma rays with energies above 1 MeV. In addition, the content of the actinide impurities in the purified metal was reduced to a total of 76 ppM. Author (NSA)

N70-27891# Central Electricity Generating Board, Berkeley (England). Research and Development Dept.

CREEP TESTS ON A SILICON-KILLED CARBON-MANGANESE PRESSURE VESSEL STEEL

J. T. Strong Jan. 1970 14 p refs
(RD/B/N-1482) Avail: AEC Depository Libraries

The combined results of uniaxial creep tests on a Si-killed boiler plate steel are presented. These tests were primarily undertaken to provide information for an environmental creep test on an experimental model pressure vessel. The results are of general interest, however, since they add to present creep data for a typical boiler plate steel (0.22% C, 0.78% Mn, and 0.2% Si). Author (NSA)

N70-27926# Westinghouse Research Labs., Pittsburgh, Pa.
LOW TEMPERATURE MECHANICAL PROPERTIES OF POLYCRYSTALLINE NIOBIUM AND MOLYBDENUM Interim Technical Report, 1 Feb. 1969 - 31 Jan. 1970
B. J. Shaw 31 Jan. 1970 25 p refs
(Contract Nonr-4442(00))
(AD-700338; ITR-70-9D2-TWINN-R1) Avail: CFSTI CSCL 11/6

The energy of twinning was found for polycrystalline niobium specimens at -196C. These results derived from dead-load tests on a modified creep machine compared with previous estimates derived from stress relaxation tests and gave an energy of the order of 10 to the 9th power ergs/cu cm. This high energy value and the metallographic features of twinning were explained in terms of a continuous nucleation theory of twinning. Initial experimental results from piezoelectric strain gauges were also given. Author (TAB)

N70-27937# Battelle Memorial Inst., Columbus, Ohio. Defense Metals Information Center.
ROOM TEMPERATURE TENSILE PROPERTIES OF LARGE 7075 T6 AND 7075-T73 ALUMINUM ALLOY FORGINGS
D. P. Moon and W. S. Hyler 30 Jan. 1970 41 p refs
(Contract F33615-69-C-1343)
(AD-702116; DMIC-MEMO-247) Avail: CFSTI CSCL 11/6

Room-temperature tensile properties were determined for large 7075-T6 and 7075-T73 aluminum-alloy forgings. Forging sizes ranged from about 1.5 to 15 inches (short-transverse direction) for production forgings and up to 20 inches for step forgings. Heat-treated thickness was 0.75 to 1.000 inch for the T6 temper but ranged up to 10 inches for the T73 temper. Regression coefficients and standard d deviations are presented for three properties (TUS, TYS, and elongation) in each of three test directions. In addition, average values and two statistical minima are tabulated for each property and test direction at each of several discrete sizes, and a comparison is made with the corresponding requirements of Specification MIL-A-22771C(ASG). Author (TAB)

N70-27961*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FURNACE AND HIGH-VELOCITY OXIDATION OF ALUMINIDE-COATED COBALT SUPER-ALLOY WI-52
Salvatore J. Grisaffe, Daniel L. Deadmore, and William A. Sanders Washington May 1970 25 p refs
(NASA-TN-D-5834; E-5307) Avail: CFSTI CSCL 11F

Aluminide-coated WI-52 was cyclic oxidation tested in furnace-air and in high velocity combustion gas environments at temperatures from 1900 to 2100 F (1038 to 1149 C). Cycle frequencies were varied from 1 to 100 hours in furnace tests while 1-hour cycles were used in the high velocity tests. At all exposure temperatures, increased cycling accelerated coating degradation because the protective aluminum oxide scale spalled during cooling. Spalling depleted the coating of aluminum and permitted less protective oxides to form. In high velocity tests, coating life decreased from 300 hours at 1900 F (1038 C) to 12 hours at 2100 F (1149 C). Author

N70-28006# Dayton Univ., Ohio. Research Inst.
THE IRON-PRASEODYMIUM PHASE DIAGRAM Yearly Summary Technical Report, 1 May 1967 - 31 May 1968
Alden E. Ray Nov. 1969 24 p refs
(Contract AF 33(615)-3793)
(AD-700769; UDRI-TR-68-29; AFML-TR-69-239) Avail: CFSTI CSCL 11/6

A phase diagram is proposed for the iron-praseodymium alloy system. Only one intermediate phase, Pr2Fe17, was observed in the system. Invariant points are the Pr2Fe17 peritectic point at 1105 plus or minus 8C and 89.5 at. % Fe and the eutectic point at 659 plus or minus 8C and approximately 18 at. % Fe. An unexplained thermal arrest at 670 plus or minus 7C was observed for alloys containing from 10 to 70 at % Fe. Author (TAB)

N70-28023# California Univ., Berkeley. Lawrence Radiation Lab.
TRIP PHENOMENA IN IMPACT TESTS
Chung Dokko (M.S. Thesis) Sep. 1969 80 p refs
(Contract W-7405-eng-48)
(PB-187812; UCRL-19068) Avail: CFSTI CSCL 11F

The investigation is concerned with the fracture toughness of high strength steels which exhibit the strain induced martensite transformation during the test, providing a good combination of strength and ductility Author (USGRDR)

N70-28024# California Univ., Berkeley. Lawrence Radiation Lab.
MAGNETIC PROPERTIES OF THE NICKEL-RHODIUM SYSTEM
Eric R. Katz (Ph.D. Thesis) Aug. 1969 159 p refs
(Contract W-7405-eng-48)
(PB-187924; UCRL-19073) Avail: CFSTI CSCL 20C

Magnetostatic and magnetic resonance studies were performed on a number of alloys in the Ni-Rh binary system. These alloys exhibit ferromagnetic behavior for nickel concentrations exceeding 63 atomic percent, and paramagnetic behavior for the more dilute alloys. The results of earlier work by Crangle and Parsons were compared with the theory developed by Stoner and Wohlfarth. The experimental data is not consonant with the predictions of this overly simplified theory. The magnetocrystalline anisotropy was determined from magnetic isotherm measurements, and the observed composition dependence followed the expected form. The spin relaxation rate was determined from the magnetic resonance data and compared with the composition dependence of the magnetocrystalline anisotropy. Again the observations failed to obey the behavior predicted by this model. Author (USGRDR)

N70-28025# California Univ., Berkeley. Lawrence Radiation Lab.
MICRO-MECHANICAL APPROACH TO STRESS CORROSION CRACKING IN TITANIUM ALLOYS
Yosef Katz (Ph.D. Thesis) Sep. 1969 108 p refs
(Contract W-7405-eng-48)
(PB-187957; UCRL-19046) Avail: CFSTI CSCL 11F

Stress corrosion cracking (SCC) in Ti-aqueous 3-1/2% NaCl systems were investigated on precracked specimens under constant load. Materials tested were commercially pure Ti-75A, alpha-beta Ti8Al-1Mo-1V and Ti5Al-2.5Sn, and all beta Ti-13V-11Cr-3Al alloys. Contoured specimens, with stress intensity (K) independent of crack length, allowed a determination of the crack propagation rate dependence on K. Such a relationship was utilized for evaluating the total time to failure in a single edge notch specimen since K = f(c) was available. Tests performed at different temperature show SCC to be a thermally activated process. The apparent activation energy was about 9.5 kcal/mole for the Ti-75A, 4.5 kcal/mole for the Ti-5-2.5 and ranged from 23. to 3.5 kcal/mole for the Ti-8-1-1. In the latter the apparent activation energy was affected by the applied stress intensity factor. Author (USGRDR)

N70-28027# California Univ., Berkeley. Lawrence Radiation Labs.
OPTIMIZATION OF CORROSION RESISTANCE IN METASTABLE AUSTENITIC STEEL
Fred J. Padilla (M.S. Thesis) Sep. 1969 61 p refs
(Contract W-7405-eng-48)
(PB-187833; UCRL-19065) Avail: CFSTI CSCL 11F

A study was made leading to the optimization of the mechanical properties and corrosion resistance of metastable austenitic steels. A metastable austenitic steel containing 13% Cr, and 0.25% C was selected as a base composition. Systematic composition changes of the other alloying elements, nickel, molybdenum, and manganese were then carried out. The effect of these composition changes on the mechanical properties were measured by means of tensile tests. A potentiodynamic polarization technique was used to follow the change in corrosion resistance in a 10% (2.04 Normal) sulfuric acid solution at room temperature.

The steels containing molybdenum exhibited the best combination of mechanical and corrosion resistant properties. Author (USGRDR)

N70-28039# California Univ., Berkeley. Lawrence Radiation Lab.
ENHANCEMENT OF DUCTILITY IN HIGH STRENGTH STEELS
Dieter Fahr (Ph.D. Thesis) Sep. 1969 159 p refs
(Contract W-7405-eng-48)
(PB-187954; UCRL-19060) Avail: CFSTI CSCL 11F

The conditions under which high strength and high ductility can be attained were studied in metastable austenitic steels. The stability of the austenite was shown to be the most important variable. It affected the tensile properties through the isothermal formation of martensite induced by elastic stresses and/or plastic strain. The results from 14 different alloys showed that low austenite stability resulted in high work hardening rates, high tensile strengths and low elongation values. Low austenite stability also caused the yield strength to decrease due to the stress induced formation of martensite. When the austenite was very stable, plastic deformation was initiated by slip and its work hardening rate was too low to prevent necking at small strains. A specific amount of strain induced martensite led to an optimum work hardening rate, resulting in maximum elongation. Author (USGRDR)

N70-28089*# Aluminum Co. of America, New Kensington, Pa. Physical Metallurgy Div.
STUDY OF CRACK INITIATION PHENOMENA ASSOCIATED WITH STRESS CORROSION OF ALUMINUM ALLOYS Final Summary Report
M. S. Hunter and W. G. Fricke, Jr. 6 Oct. 1969 306 p refs
(Contract NAS8-20396)
(NASA-CR-102474) Avail: CFSTI CSCL 11F

An investigation has been made of stress-corrosion crack initiation phenomena in thick plate of 2219, 7075, X7375, 7079 and 7039 alloys with emphasis on the short-transverse direction. Techniques used included light and electron microscopy, electron fractography, X-ray and electron diffraction, the electron microprobe and acoustic emission monitoring. A number of effects were evaluated including those of structure and structural evolution, grain orientation, stress level and direction, surface roughness and pre-corrosion, surface film, and environment. Author

N70-28145# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THERMAL STRENGTH OF MATERIALS AND STRUCTURAL ELEMENTS
S. A. Gryaznov et al. 2 Dec. 1969 63 p refs Transl. into ENGLISH from the Russian
(AD-702152; FTD-HT-23-12-69) Avail: CFSTI CSCL 11/6

Contents: Apparatus for investigating the high-temperature endurance of refractory metals and refractory-metal alloys in vacuo; Certain results of studies of the low-cycle fatigue of a heat-resisting steel; Apparatus for studying the endurance of heat-resisting alloys with programmed variation of temperature and load; Effect of stress concentrators on the thermal-fatigue resistance of EI703 heat-resisting steel sheet; Thermal stresses in nozzle blades of gas turbines; Apparatus for studying the heat resistance of turbine blades under conditions of simultaneous thermal and mechanical loading; Study of the plastic deformation of nonuniformly heated rotating disks; Method of studying the heat resistance of structures with heat-protection coatings. TAB

N70-28219# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COMPLEX STUDY OF THE BASIC STAGES OF STRUCTURAL DAMAGE IN THE FATIGUE OF CERTAIN FERROUS ALLOYS
B. I. Kostetskii et al. 8 Jan. 1970 14 p refs Transl. into ENGLISH from the Publ. "Prochnost Metallov Pri Tsiklicheskikh Nagruzkakh Materialy Soveshchaniya po Ustalosti Metallov 4th 1966" Moscow, Nauka., 1967 p 82-87
(AD-701982; FTD-HT-23-314-69) Avail: CFSTI CSCL 11/6

A complex method was developed for obtaining diagrams of fatigue failures by means of electrical induction tests, x-ray diffraction, light and electron microscopy, and microhardness tests. Fatigue tests of Armco Fe and 0.08% C steel were made at 12-40 kg/sq mm loads and 5 Hz. frequency. The development of submicroscopic cracks and further disintegration of the metal are discussed and illustrated by electron micrographs. Author (TAB)

N70-28220# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
INTERPREATION OF THE HEAT BEHAVIOUR OF METALS BY THE USE OF AN INTEGRAL LAW [DESCRIPTION DU COMPORTEMENT DES METAUX A CHAUD A L'AIDE D'UNE LOI INTEGRALE]
M'Hamed-Ali Souissi (Ph.D. Thesis—Paris Univ., 25 Mar. 1969) 1969 50 p refs In FRENCH; ENGLISH summary
(ONERA-NT-152) Avail: CFSTI

To account for the heat behaviour of metals, some hypotheses are drawn on to lay down an integral type behavior law. Equivalent to a law of differential character, this creep type integral law can be numerically solved with respect to stresses by means of successive approximations and by a step-by-step method. Next certain variational principles are established, and two uniqueness theorems relating to some problems are demonstrated. The law put forward here is tested against a three-dimensional experiment involving a thin cylinder subjected in turn to traction, torsion, and internal pressure. Author

N70-28296# Naval Research Labs., Washington, D.C.
METALLURGY: PROBLEM NOTES
In its Rept. of NRL Progr. Mar. 1970 p 30-41 refs (See N70-28291 14-34)
Avail: CFSTI

Metallurgical studies reported on include: (1) statistical correlation of speedwise variation in the fracture toughness of three mild steels; (2) analysis of the microstructures of high-strength steels; (3) spinel formation in the Ni-Al203 system; (4) the NiAl204 spinel-cation distribution; (5) radiation damage of metals exposed to neutron flux in water reactors; and (6) interaction of heat flow and solid-liquid micromorphology. D.L.G.

N70-28304# Bureau of Mines, Albany, Oreg. Metallurgy Research Center.
COLUMBIUM ALLOY DEVELOPMENT WITH BORON, HAFNIUM, AND TUNGSTEN
H. R. Babitzke, L. L. Oden, and H. J. Kelly Jun. 1970 34 p refs
(BMRI-7388) Avail: CFSTI

As part of a continuing project to develop refractory metal alloys for high-temperature structural applications, solid solution and precipitation strengthening techniques were applied to improve the properties of columbium alloys. The purpose was to investigate the effects of hafnium, tungsten, and boron on the formability, strength, and oxidation resistance of columbium. The experiment was of factorial design with two replications which called for 72 ingots of 36 basic compositions, weighing 150 grams each. Hafnium, tungsten, and boron were evaluated at 3, 3, and 4 levels, respectively. Values of alloy content are all in atomic percent. The fabricability of the alloys high in boron became increasingly difficult, resulting in an inadequate number of alloys required for a complete statistical analysis for all the tests. As a result of the decrease in ductility, an insufficient quantity of tensile samples were available for a proper analysis for the high-temperature strength data. Author

N70-28319# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Material- und Festkoerperforschung.

PROBLEMS OF ISOTHERMAL STEAM CORROSION OF INCOLOY 800 ALLOYS IN RELATION TO SURFACE TREATMENT

S. Leistikow, E. Pott, and H. V. Berg Jul. 1969 46 p refs In GERMAN

(KFK-1054) Avail: AEC Depository Libraries

The influence of various surface treatments on the isothermal steam corrosion of Incoloy Alloy 800 sheet specimens was tested by semidynamic loop experiments at 620 C and 1 atm during 5000 to 10,000 hours. The experiments were evaluated by gravimetric measurements, electromicroscopic and metallographic methods, chemical analysis of steam condensate, oxide scale, and diffusion zone composition. The good corrosion resistance of Incoloy Alloy 800 is based on the protective character and mechanical stability of the oxide scale which is formed on pickled and electropolished specimens during the first 1000 hours of exposure as a thick, adherent, and non-steam soluble layer. During longer exposure the oxide growth rate slows down and can be approximated by a linear rate law. The multiphase oxide structure and composition was analyzed. While the linear rate constants of metal oxidation and metal loss-to-system are nearly equal the small oxide scale thickness remains constant and maintains its protective character. Author (NSA)

N70-28374# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorentwicklung.

SODIUM PROPERTY DATA

A. Pee Feb. 1969 86 p refs

(EURFNR-627; KFK-924) Avail: CFSTI

A number of FORTRAN-4-functions were described with which the entropy of sodium could be calculated in the temperature range from 260 to 1400 C. NSA

N70-28447# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CAVITATION AND HYDRAULIC ABRASIVE STABILITY OF METALS IN HYDRAULIC TURBINES (SELECTED ARTICLES)

V. V. Gavranek et al 30 Oct. 1969 37 p refs Transl. into ENGLISH from Kavitatsiya i Gidroshlifuyushchaya Stoikost Metallov v Gidravlicheskikh Turbinahk (USSR), 1965 p 105-125

(AD-702331; FTD-MT-24-267-69) Avail: CFSTI CSCL 11/6

In the planning of new hydroelectric power plants located on mountain rivers it is necessary to estimate the abrasive ability of river deposits and degree of their danger for hydroturbines. Such appraisal can be made on the basis of comparison of conditions of deposits on the planned hydroelectric power plant and any others close to it in pressure and composition of deposits of an operational hydroelectric power plant equipped with analogous turbines, under the condition that on latest hydroelectric power plants there is well studied the wear of turbined and conditions of deposits. Using the proposed method, a forecast can be made of the degree of danger of erosional destruction under influence of deposits contained in river water both on the whole for turbines made from carbon steel of newly planned hydroelectric power plants and for their individual parts. TAB

N70-28483# Ministry of Technology, London (England). Materials Div.

THE EFFECT OF COMPOSITION AND TENSILE STRENGTH ON THE SUSCEPTIBILITY OF ALLOY STEELS TO CADMIUM PLATING HYDROGEN EMBRITTLEMENT

P. F. Langstone Oct. 1968 37 p refs

(AD-700590; D-MAT-159) Avail: CFSTI CSCL 11/6

Sustained load, fracture toughness and bend tests were made to determine the susceptibility to cadmium plating (hydrogen) embrittlement of a range of 3% chromium-molybdenum-vanadium steels of different carbon contents, impurity contents, and tensile strengths. Comparison was made with 2% copper-silicon-molybdenum steels and 18% nickel maraging steels. Sustained load life and critical crack size fell sharply with increase of tensile strength from 110 to 120 tonf/sq in. Variation in carbon content at constant tensile strength had little effect. Most impurity elements were somewhat detrimental but 0.016% sulphur appeared beneficial. Extension of baking times at 200C after plating prolonged sustained load life but did not always eliminate failure. The maraging steels were much more resistant to plating embrittlement than the two low alloy steels. Author (TAB)

N70-28593# Iowa State Univ. of Science and Technology, Ames. Dept. of Physics.

LOW TEMPERATURE THERMAL EXPANSION OF COPPER, SILVER, GOLD, AND ALUMINUM

Kent Otho Mc Lean (Ph.D. Thesis) Nov. 1969 97 p refs

(Contract W-7405-eng-82)

(IS-T-337) Avail: CFSTI

Values are given for the thermal expansion coefficient for copper, silver, gold, and aluminum from 2.5 to 27 K. The precision of the measurements corresponds to an uncertainty of + or - 2.5% at the lowest temperatures and + or - 1% above 6 K. Comparison of the results with less precise data obtained from other experimental techniques shows good agreement between the present copper data obtained with the variable transformer method and that obtained from the twisted strip dilatometer technique. Lattice and electronic Grupeisen parameters at T = 0 calculated from the thermal expansion results are given. The lattice Gruneisen parameter exhibits a temperature dependence similar to that of the equivalent Debye temperature. NSA

N70-28619# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

TRANSACTIONS OF THE POLYTECHNIC INSTITUTE OF LENINGRAD

K. P. Lebedev et al 8 Jan. 1970 17 p refs Transl. into ENGLISH from Tr. Leningr. Politekhn. Inst. (Moscow), no. 295, 1968 p 45-64

(AD-701980; FTD-HT-23-209-69) Avail: CFSTI CSCL 11/6

Contents: Development and investigation of cast heat-resistant steel PZh1 for working temperatures of 600-750C; Heat-resistant casting alloy containing nitrogen for temperatures 600-670C. TAB

N70-28636# Bureau of Mines, Reno, Nev. Metallurgy Research Center.

DEVELOPMENT OF HIGH-TEMPERATURE VANADIUM-BASE ALLOY

G. H. Keith and J. S. Winston Jun. 1970 17 p refs

(BM-RI-7393) Avail: CFSTI

A vanadium base alloy consisting of the following elements in weight percent molybdenum, 20; titanium, 10; carbon, 0.1; silicon, 0.5; and yttrium, 0.5 had exceptionally high strength at temperatures up to 1,200 C. This alloy was capable of fabrication to sheet of approximately mm thickness by a combination of hot swaging and hot and warm rolling. In the warm rolled condition at ambient temperature, its ultimate tensile strength was 1,205 sq m. The strength at 1,200 C was 150 MN/sq m. Within the temperature range of 25 deg to 1,200 C, the ductility of the alloy as measured by elongation increased from 4 to > 90 percent. Strengthening was achieved by both solid solution and dispersed phase mechanism. Alloys of 20 percent molybdenum and 10 percent titanium were stronger than the other molybdenum-titanium alloy compositions tested. Strength was increased 15 percent in the temperature range of 25 to 800 C with no accompanying loss in ductility, by the addition of 0.5 percent silicon. Workability was improved by additions of 0.25 and 0.5 percent yttrium. Author

N70-28702# Joint Publications Research Service, Washington, D.C.
HYDROGEN IN THE WELDING OF STEEL HULLS
Rudolf Aleksandrovich Kozlov 4 May 1970 215 p refs Transl. into ENGLISH of the book "Vodorod pri Svarke Korpusnykh Staley" Leningrad, Sudostr., May 1968 p 1–176
(JPRS-50459) Avail: CFSTI

Information is presented about the effect of hydrogen and welding material on the quality of welded structures. Information regarding the quantitative dependence of the brittleness of welding material on the presence of hydrogen, as well as regarding hydrogen diffusion into the weakness zone is presented. Also discussed are measures for reducing the amount of hydrogen and lessening its influence on cold brittleness and pore formation. Methods are presented for determining the amount of hydrogen in weld metal and deposited metals and the dependence of this amount on technological factors and the type of welding. This book is intended for designers, process engineers and skilled welders of the shipbuilding industry. Author

N70-28827# Oak Ridge National Lab., Tenn.
COMPUTER PROGRAM FOR THE SIMULATION OF SOLID SOLUTIONS FROM X-RAY DATA
R.O. Williams Mar. 1970 41 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2866) Avail: CFSTI

The structure of binary solid solutions may be simulated in the sense that one can generate a finite model of two kinds of atoms which will reproduce in several shells average populations which are in agreement with those deduced from diffuse x-ray measurements. The model should be fairly large to give good statistics, but this can result in appreciable computing times. The present program uses efficient algorithms with nearly optimum coding which result in its being 100 times faster than a previous program. The documentation and characterization of this program are given. Author (NSA)

N70-28927# Maryland Univ., College Park.
STUDY OF ALLOY STRENGTHENING DUE TO ATOMIC ORDER Progress Report, 1 May 1969 – 30 Apr. 1970
M.J. Marcinkowski 30 Apr. 1970 47 p refs
(Contract AT(40-1)-3935)
(ORO-3935-3) Avail: CFSTI

Compressive stress-strain curves have been obtained for a large number of metals and alloys in both the ordered and disordered configurations. The deformation behavior of these materials can be rationalized in terms of three distinct stages. Each of these stages has been accounted for in terms of the dislocation configuration existing in the particular material. Author

N70-28955# Oak Ridge National Lab., Tenn. Technical Information Div.
USE OF RADIOTRACERS IN THE STUDY OF THE EFFECT OF SILICON ON VARIOUS PROPERTIES OF THE GRAIN BOUNDARIES OF AUSTENITIC STAINLESS STEELS
A. Desestret et al [1969] 31 p refs Transl. into ENGLISH from Mem. Sci. Rev. Met. (Paris), no. 66 p 389–405 Presented at the Autumn Meeting of the French Soc. of Met., Paris, Oct. 1967 Sponsored by AEC
(ORNL-tr-2281) Avail: CFSTI

The technique of radiotracers and measurements of intergranular autodiffusion have been used to study the effect of silicon on various properties of the grain boundaries of austenitic stainless steels. Autoradiography permits establishing a direct relation between the more or less coherent character of a grain boundary and the presence of a radioelement in this boundary after diffusion treatment. Radiotracers were also used directly for experiments of corrosion, either on specimens whose boundaries were tagged by iron 59 or on metal which had been previously irradiated in a reactor. Counting techniques were used to follow by sampling in the region of attack the first stages of intergranular corrosion and to establish the nature of the boundaries which are most sensitive to this phenomena. A.L.

N70-29009# McElroy (Ralph) Co., Austin, Tex.
REALISTIC STRESS CORROSION TEST
P. Brenner [1969] 18 p refs Transl. into ENGLISH from Metall. Intern. z. Tech. Wirtschaft, v. 23, no. 9, Sep. 1969 p 879–886 Transl. for California Univ., Livermore, Lawrence Radiation Lab.
(UCRL-Trans-10432) Avail: CFSTI

Recommendations are given for stress corrosion testing which include the choice of simple invididual samples that approximate the actual conditions with respect to shape, dimensions, processing, surface makeup, and manner of removal from the half-finished product, mechanical stressing of the specimen by a defined residual strain produced by a reproducible plastic cold-forming process, preferred use of NaCl solutions as electrolytes, simultaneous testing of a large number of similar specimens at two different tensions to determine the stress-life span line, shortening the test duration by selecting high testing and residual stresses, and more frequent systematic comparative experiments in the laboratory and under natural conditions. Author

N70-29068# National Physical Lab., Teddington (England). Div. of Inorganic and Metallic Structure.
INFLUENCE OF MULTIPLE-MECHANICAL-THERMAL-TREATMENT ON THE STRUCTURE AND TENSILE PROPERTIES OF Fe-C ALLOY
L. K. Gordienko, Y. Lieberov, and D. McLean Feb. 1970 15 p refs
(NPL-IMS-9/70) Copyright. Avail: CFSTI

Using an iron-0.05% carbon alloy, multi-mechanical-thermal-treatment (mmtt) was compared with normal tensile straining as regards its influence on dislocation structure and mechanical properties. After three cycles of mmtt, the new yield stress greatly exceeded the original (370 N/sq mm compared with 186) and even exceeded the original uts (337 N/sq mm) while the uniform elongation remained appreciable at 7.7%. The treatment thus strengthens more effectively than ordinary strain hardening and loses less ductility in doing so. The dislocation density, uniformity, and strengthening efficiency after a given strain are greater in the mmtt condition than in the normal condition. Author (ESRO)

N70-29069# Brookhaven National Lab., Upton, N.Y.
HIGH-TEMPERATURE LIQUID-METAL TECHNOLOGY REVIEW, VOLUME 7, NO. 5 Bimonthly Technical Progress Review
Oct. 1969 24 p refs Sponsored by AEC
(BNL-50215) Avail: CFSTI

Reviews of topical and progress reports operating under contracts with AEC, NASA, and the Air Force are presented. Reviews are included on thermodynamics, fluid dynamics, heat transfer, materials properties and development, instruments, components, chemistry, systems, fabrication, and safety. NSA

N70-29089# Michigan State Univ., East Lansing. Dept. of Chemistry.
THE YTTERBIUM-CARBON SYSTEM: VAPORIZATION OF YbC(1.25 PLUS y)
John M. Haschke and Harry A. Eick [1969] 12 p refs Presented at the 8th Rare Earth Conf., Reno, Nev.; Sponsored by AEC
(COO-716-53; Conf-700403-1) Avail: CFSTI

The ytterbium carbon system, YbC sub x, has been investigated. Samples were prepared by direct reaction of the elements in sealed tantalum bombs. A linear variation of the carbon-rich phase boundary and the monoclinic b parameter with temperature have been observed. The equilibrium vapor pressure of gaseous ytterbium

in the two-phase region has been measured by a target collection Knudsen effusion technique. A partial phase diagram for the Yb - C system is proposed, third law enthalpy data are presented, and the variation of composition and lattice parameter is discussed. Author (NSA)

N70-29113# State Univ. of New York, Stoney Brook. Coll. of Engineering.
STUDY OF MICROPLASTIC BEHAVIOR OF TUNGSTEN AND OTHER REFRACTORY METALS IN RELATION TO THE BRITTLE FRACTURE PROBLEM Progress Report, 1 Apr. - 31 Dec. 1969
John C. Bilello 31 Dec. 1969 16 p refs
(Contract AT(30-1)-4073)
(NYO-4073-1) Avail: CFSTI

A system for measuring microplasticity and strain rate response of materials over a temperature range of 4.2 to 300 K was designed and built. Preliminary measurements on polycrystalline tungsten indicated that three distinct regions of strain rate behavior occurred in cases where a yield-point is observed. The temperature dependence of the friction stress in single crystal tungsten was found to be similar to that of the flow stress. Correlation of the dislocation structure with the measured low frequency mechanical hysteresis of the same Cu crystals showed that primary-forest junctions with binding energies were the pinning agents controlling the damping behavior. Author (NSA)

N70-29164# Illinois Univ., Urbana. Materials Research Lab.
MOESSBAUER STUDY OF THE TEMPERING OF MARTENSITE
Charles Russell Rarey Feb. 1970 58 p refs
(Contract AT(11-1)-1198)
(COO-1198-701) Avail: CFSTI

Three sets of six peaks were noted in the freshly quenched martensite, and a range of iron environments was indicated by the broadening of these peaks. A new six peak spectrum with a field of about 225 kOe at 90 K was attributed to a new carbide, which developed upon tempering before the appearance of epsilon carbide. The six peak spectrum of epsilon carbide corresponds to a field of about 350 kOe at 90 K. The chromium steel tempered much more slowly than the nickel steel. NSA

N70-29177# General Electric Co., Sunnyvale, Calif. Breeder Reactor Development Operation.
MECHANICAL PROPERTIES EVALUATION OF AUSTENITIC STAINLESS STEELS IRRADIATED IN EBR-2
T. Lauritzen, A. Withop, and G. P. Ferguson Jul. 1969 89 p refs
(Contract AT(04-3)-189)
(GEAP-10066) Avail: CFSTI

Tensile coupons of five austentic materials (Types 304, 316, 321, 347, and Incoloy-800) prepared from thin-wall tubing were irradiated in EBR-II. The maximum accumulated neutron exposure was 3.4 × 10 to the 22nd power n/sq cm, total, at 1000 to 1300 F. The mechanical properties of the irradiated coupons were determined. Postirradiation mechanical testing included uniaxia tensile and burst (biaxial) tests at temperatures ranging from 900 to 1500 F. Light optical and electron metallography studies were conducted to characterize the mode of failure. Heat treatment for Type-304 stainless steel to produce a carbide agglomerated state was found to promote increased residual ductilities after reactor exposure. This observation, which needs confirmation, is in contrast to larger reductions in ductility (measured by percent elongation) found for all five commercial austenitic alloys used in these experiments in the as-received or mill-annealed condition. Author (NSA)

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N70-27806# Naval Research Lab., Washington, D.C. Ocean Technology Div.
PREDICTION OF THE STRENGTHS OF INTERNAL CAVITIES IN GLASS UNDER COMPRESSIVE LOADS Interim Report
Joseph A. Kies, Robert J. Sanford, Daniel R. Mulville 30 Jan. 1970 23 p refs
(AD-702397; NRL-7020) Avail: CFSTI CSCL 11/4

The compressive strength of bulk glass is limited by the tensile strength of the surfaces of internal cavities, especially clusters of cavities closely spaced so as to have strongly interacting stress fields. The tensile stress on the surfaces of single ellipsoids were taken from a previous report, and predictions of probabilities of failure were made based on an assumed Weibull distribution of strengths. Numerical values for Weibull coefficients were used which were believed to be representative of pristine glass but not homogenized by extended heat treatment. The predictions are thought to be somewhat conservative but could easily be adjusted in the light of better experimental data if and when they become available. The assumed m coefficients are believed to be realistic but the assumed sigma(o), i.e., the strength of pristine bubbles of unit area at a probability of failure of 0.63, may need future revision. All predicted strengths are proportional to sigma(o). Predicted strengths are shown graphically for probabilities of failure ranging from 10 to the -6th to 10 to the -1st. Author (TAB)

N70-27810# United Aircraft Corp., East Hartford, Conn. Research Labs.
THE CREEP AND FRACTURE BEHAVIOR OF Al-Al3Ni EUTECTIC WHISKER COMPOSITES
Edward M. Breinan, Earl R. Thompson, Gerald P. McCarthy, Walter J. Hermann, Warren K. Tice et al 28 Feb. 1970 105 p refs
(Contract N00014-67-C-0478)
(AD-702418; UACRL-J910582-7; TR-2) Avail: CFSTI CSCL 11/4

A series of Al3Ni eutectic creep specimens was fabricated from ingots solidified at 11.0 cm/hr and these specimens were creep tested at a single set of conditions to plastic strains in the first, second, and third stages of creep, and to rupture. The tests were then interrupted and the specimens were sectioned and examined by transmission electron microscopy. It was found that due to the small plastic strains encountered in the first and second stages (epsilon sub p = or < 0.3%) of creep, relatively little substructure buildup was encountered in these specimens. In specimens tested to rupture dense dislocation cells keyed on the whiskers were found. As a result, a time dependent fracture mechanism was identified which was quite different from normal tensile fracture, and this mechanism was related to the substructure buildup. Solidification experiments conducted at approximately 35 cm/hr resulted in the formation of a dual-orientation microstructure in which portions of the whiskers were misaligned from the nominal growth direction. This structure was found to be extremely detrimental to creep behavior. The modes by which premature specimen failure occurred were identified and the fracture mechanisms determined. Microstructural characterization studies were conducted on ingots solidified over a range of rates from 3.5 to 35 cm/hr. Author (TAB)

N70-27818# Aerospace Corp., El Segundo, Calif. Lab. Operations.
SHORT-TIME CREEP BEHAVIOR OF CARBON, GRAPHITE, AND SILICA PHENOLIC COMPOSITES AT ELEVATED TEMPERATURES, JULY 1968 - AUGUST 1969
Alfred Ching and James D. Buch 30 Jan. 1970 22 p refs
(Contract F04701-69-C-0068)
(AD-702436; TR-006(5112-22)-1; SAMSO-TR-70-57) Avail: CFSTI CSCL 11/4

Short-time tensile creep behavior of carbon, graphite, and silica phenolics at elevated temperatures was determined for durations up to 40 sec. A plasma arc was used as a heat source, with test temperatures ranging from 1095 to 2760C. The results show appreciable amounts of creep strain, especially for the higher temperature and stress levels. The magnitude of these strains suggests that a complete structural analysis should take account of creep and creep rupture. A surprising result is that the activation energies of creep for carbon, graphite, and silica phenolics are experimentally identical. Observation of identical creep activation energies for composites based on these widely different fibers is contrary to intuitive expectations, since the fiber is usually thought to be dominant in mechanical behavior. Author (TAB)

N70-27870# Princeton Univ., N.J. Frick Chemical Lab.
THERMAL STABILITY OF NETWORKS CONTAINING SILOXANE LINKAGES
Montgomery T. Shaw and Arthur V. Tobolsky Feb. 1970 12 p refs
(Contract N00014-67-A-0151-0011)
(AD-700933; ONR-TR-RLT-120) Avail: CFSTI CSCL 11/10

The thermal stability of elastomers containing siloxane linkages was compared using the technique of chemical stress relaxation in an inert environment. Enhancement of the already high stability of the basic poly(dimethyl-siloxane) silicone rubber by the substitution of hetero groups in and on the main chain was proved. Particularly dramatic was the effect of the m-carborane moiety in SB-2 elastomers which enhanced the thermal stability of the siloxane chain by more than 100C. Author (TAB)

N70-27916# Ohio State Univ. Research Foundation, Columbus.
FATIGUE CRACK PROPAGATION IN RESIN-FIBER COMPOSITES Final Technical Report, 1 Jan. - 31 Dec. 1968
Richard W. Hertzberg (Lehigh Univ.), John A. Manson (Lehigh Univ.), and Hans Nordberg (Lehigh Univ.) Nov. 1969 26 p refs Prepared by Lehigh Univ.
(Contract F33615-67-C-1559)
(AD-700434; AFML-TR-69-92) Avail: CFSTI CSCL 11/9

An exploratory study of fatigue crack propagation in both boron and glass fiber reinforced epoxy resins was begun. An attempt was made to relate the concepts of fracture mechanics to the fatigue process. Under the test conditions employed, the epoxy resin ERL 2256 was found to be extremely brittle and to posses limited capacity for stable crack extension. Due to the brittle behavior of the epoxy resin and the inability to maintain stable fatigue crack propagation, a series of fatigue tests were performed on several different polymer materials representing different classes of mechanical response. Fatigue crack propagation rates between 0.000005 in/cycle and 0.0004 in/cycle were measured in nylon, polycarbonate, ABS resin, low-density polyethylene and polymethyl methacrylate. A strong correlation was found between the fatigue crack propagation rate and the stress intensity factor prevailing at the advancing crack tip. Whereas metals exhibit comparable fatigue growth rates for a given stress intensity range when normalized with respect to elastic modulus, the polymer materials exhibited a 1300-fold difference in crack growth rate for a given normalized stress intensity range. This observation dramatically illustrates the importance in understanding the energy dissipation processes in polymer materials as related to their chemistry and architecture. Author (TAB)

N70-27924# Boeing Co., Seattle, Wash. Aerospace Systems Div.
THERMAL CONDUCTIVITY OF PHENOLIC-CARBON CHARS Final Report, 1 Apr. 1968 - 30 Dec. 1969
Wilson A. Clayton, Thomas J. Fabish (Battelle Memorial Inst., Columbus, Ohio), and John F. Lagedrost (Battelle Memorial Inst., Columbus, Ohio) Dec. 1969 184 p refs
(Contract F33615-68-C-1416)
(AD-702112; AFML-TR-69-313) Avail: CFSTI CSCL 11/4

The thermal conductivity of several phenolic-carbon and phenolic-graphite ablative composites was established as a function of layup angle and temperature for ablation heating or cooling from -10F to over 5000F. Conductivity was measured on virgin and charred FM-5055A phenolic-carbon as a function of layup angle and heating or cooling temperature to 5000F. These measurements were made by the steady-state, unidirectional, comparative disk method. Furnace charred conductivity specimens were shown to represent ablation chars by detailed characterization and by comparative thermal diffusivity measurements. Theory relating the constituent (cloth and matrix) and composite conductivities was used to correlate the new conductivity data and literature data on composites having the same reinforcements. The procedure provides correlated constituent conductivities for CCA-1 standard and high purity carbon cloth, WCA and WCB graphite cloth, and carbon powder filled and unfilled 91-LD and SC 1008 virgin or charred phenolic resins, from which the conductivity of virgin or charred composites is obtained within the accuracy of composite conductivity measurements. All results are expressed as equations for direct substitution in ablation computer programs, which was demonstrated for ballistic reentry ablation of FM-5055A phenolic carbon. The thermal conductivity of all carbon or graphite cloth reinforced phenolics increases versus layup angle and reinforcement volume fraction, is reduced by pyrolysis generated porosity, and increases in the mature char versus temperature and the degree of graphitization. Author (TAB)

N70-27946*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RADIATION INDUCED OUTGASSING
Raymond L. Gause *In its* Radiation Phys. Res. at MSFC: Res. Achievements Rev., v. 3 1969 p 25-34 refs (See N70-27942 14-24)
Avail: CFSTI CSCL 18J

A program was initiated to generate quantitative gas yield data for various polymeric materials considered to be appropriate for application on a nuclear vehicle. The program is described and the gas yield data that were obtained for 10 different polymers are presented. The data, presented in terms of G-values (defined as the number of gas molecules formed by the absorption of 100 eV of energy), show that considerable quantities of gases are evolved by these materials and that radiation induced outgassing, if not considered in the design of a nuclear stage, could have a significant deleterious effect on vehicle performance and reliability. Author

N70-28045*# Autonetics, Anaheim, Calif.
POLYMERIC FILMS FOR SEMICONDUCTOR PASSIVATION
S. M. Lee Mar. 1970 96 p refs
(Contract NAS12-2011)
(NASA-CR-86383) Avail: NASA Scientific and Technical Information Facility, P. O. Box 33, College Park, Md. 20740 CSCL 11C

Parylene, high-purity and pinhole-free polymeric films were assessed to determine the feasibility of employing this coating as either a replacement or an adjunct to inorganic passivation layers or as a barrier coating capable of maintaining the semiconductor surface free of moisture, ions, and other contaminants. Test results have demonstrated that Parylene functions as an excellent barrier coating material for semiconductor devices. This polymeric material provides the device with a gas and moisture barrier and prevents any lowering of insulation resistance. The disposition process and

material represents a unique approach to passivation. To study the effects of temperature and electrical stress on semiconductor devices coated with various Parylenes, the Rel-chip which enables the determination of immediate and magnified changes in critical electrical device parameters for MOS and IC devices was used. The devices on the Rel-chip which can be measured electrically included four MOS transistors, four diodes, a diffused resistor metal test strip, and a MOS capacitor. Author

N70-28047*# Peninsular ChemResearch, Inc., Gainesville, Fla.
DEVELOPMENT OF VULCANIZABLE ELASTOMERS SUITABLE FOR USE IN CONTACT WITH LIQUID OXYGEN, ANNOTATED BIBLIOGRAPHY Final Summary Report, May 1963 - May 1969
Oct. 1969 94 p refs
(Contract NAS8-5352)
(NASA-CR-102228) Avail: CFSTI CSCL 11I

This bibliography was prepared from references obtained mainly from Chemical Abstracts, but contains, in addition, references taken from a number of primary sources. Major emphasis was placed on references to fluorine-containing monomers and polymers and to thermal properties of all classes of polymers. The great number of references in the categories covered necessitated selecting references which were considered to be of most significance to the present investigation. The choice of references is somewhat subjective, but it is felt that the cross section given is a useful representation of the literature to date. Author

N70-28082*# IIT Research Inst., Chicago, Ill. Technology Center.
DEVELOPMENT OF SPACE-STABLE THERMAL-CONTROL COATINGS Triennual Report, 1 Oct. -31 Dec. 1969
G. A. Zerlaut and N. A. Ashford 20 Feb. 1970 54 p refs
(Contract NAS8-5379; IITRI Proj. U6002)
(NASA-CR-102654; IITRI-U6002-85) Avail: CFSTI CSCL 11B

Results of the in situ optical spectroscopy of ultraviolet-irradiated, reactively encapsulated (surface treated) zinc ortho-titanates (Zn_2TiO_4) are discussed. The data are compiled and, in conjuction with the results of electron paramagnetic resonance (epr) spectroscopy, the effects of various treatments are evaluated. These studies show that the single most important factor in achieving optical stability with Zn_2TiO_4 is the employment of excess approximately 0.5% ZnO in the preparative reaction. Of secondary importance, are surface treatments such as plasma annealing, potessium silicate, sodium acid phosphate, and iron cyanide. Among the reactive surface treatments, silicating (preparation of potassium silicate-based coatings) is the most effective in improving stability of Zn_2TiO_4. Irradiation at high temperature (i.e., approximately 165 C) causes severe damage to silicate and silicone paints prepared from Zn_2TiO. The powders exhibited greater stability to high-temperature irradiation. Author

N70-28105*# Los Alamos Scientific Lab., N.Mex.
CMF-13 RESEARCH ON CARBON AND GRAPHITE Progress Report, 1 Nov. 1969 - 31 Jan. 1970
Morton C. Smith 31 Jan. 1970 28 p ref Sponsored in part by NASA
(Contract W-7405-eng-36)
(NASA-CR-109887; LA-4417-MS; PR-12) Avail: CFSTI CSCL 11G

Research and development on carbon and graphite were undertaken primarily to increase understanding of their properties and behavior as engineering materials, to improve the raw materials and processes used in their manufacture, and to learn how to produce them with consistent, predictable, useful combinations of properties. The approach taken is microstructural, based on study and characterization of natural, commercial, and experimental carbons and graphites by such techniques as x-ray diffraction, electron and optical microscopy, and porosimetry. Physical and mechanical properties are measured as functions of formulation, treatment, and environmental variables, and correlations are sought among properties and structures. Raw materials and manufacturing techniques are investigated, improved, and varied systematically in an effort to create specific internal structures believed to be responsible for desirable combinations of properties. Author

N70-28149# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TECHNOLOGICAL PROPERTIES OF GLASS-BASE LUBRICANTS USED IN EXTRUSION
V. F. Vdovin 31 Dec. 1969 10 p Transl. into ENGLISH from Nauchn. Tr., Dnepropetr. Met. Inst. (Moscow), no. 53, 1967 p 220-222
(AD-701976; FTD-MT-24-318-69) Avail: CFSTI CSCL 11/8

The documents deals with the applicability of vitreous lubricants in hot extrusion. The optimal viscosity of the glass lubricants used is 100-300 poises and the optimal quality of the extruded products is assured when the thickness of the layer of lubricants of this kind is 20 Mu. Such conditions assure fluid friction during hot extrusion in the presence of vitreous lubricants. In this connection, it is shown that the antifriction properties of vitreous lubricants used in hot extrusion of metals can be expressed by introducing the concept of the technologicity index. Author (TAB)

N70-28454# Whittaker Corp., San Diego, Calif. Research and Development Div.
FURTHER INVESTIGATIONS INTO THE MICRODYNAMICS OF WAVE PROPAGATION Annual Summary Report, Jun. 1968 - Jun. 1969
Juan Haener and Alberto Puppo Wright-Patterson AFB, Ohio AFML Aug. 1969 40 p refs
(Contract F33615-67-C-1894)
(AD-702108; MJO-341; AFML-TR-68-311-Pt-2) Avail: CFSTI CSCL 11/4

This continuing analytical program is concerned with establishing equations to define wave propagation in unidirectional, multifiber-reinforced composites. Work this year indicated that the exact solutions and the approximate solutions given in Technical Report AFML-TR-68-311 (October 1969) yield the same numerical results for displacements, stresses, and propagation velocities. It was found that only the fundamental propagative mode in a composite material can propagate waves. The higher modes have cut-off frequencies, below which propagation is impossible. Calculations showed that, the stiffer the composite, the higher the cut-off frequency will be. Further studies pointed out that cross-section geometry affects stresses substantially but does not influence the velocities of propagation. Author (TAB)

N70-28472# Utah Univ., Salt Lake City. Div. of Materials Science and Engineering.
IMPURITY EFFECTS ON THE CREEP OF POLYCRYSTALLINE MAGNESIUM AND ALUMINUM OXIDES AT ELEVATED TEMPERATURES Technical Progress Report, 19 Dec. 1968 - 18 Dec. 1969
Ronald S. Gordon Dec. 1969 31 p refs
(Contract AT(11-1)-1591)
(UTEC-MSE-69-158; COO-1591-10) Avail: CFSTI

The research activities during the period December 19, 1968 to December 18, 1969 are summarized. Major effort was devoted to the following: (1) a complete reconstruction of the vacuum hot press for operation at temperatures higher than were possible with the previous equipment, (2) a redesign and reconstruction of the creep testing facilities, (3) preliminary experiments on the effects of oxygen partial pressure on the creep of polycrystalline magnesium oxide doped with Fe_2O_3, (4) completion of the grain growth studies in magnesium oxide and magnesiowustite, (5) completion of the analytical study on the calculation of strains and strain rates in the inelastic bending of beams, and (6) continued analysis of grain size distributions. A complete listing of the Bibliography of papers and thesis is included. Author

N70-28496# North Carolina State Univ., Raleigh. School of Textiles.
A FUNDAMENTAL RESEARCH STUDY OF THE CONVERSION OF POLYMERS TO FIBERS Final Summary Technical Report, May 1966 – Sep. 1969
Robert W. Work and John A. Cuculo Nov. 1969 331 p refs
(Contract AF 33(615)-3850)
(AD-700404; AFML-TR-67-173-Pt-3) Avail: CFSTI CSCL 11/5

A dry spinning machine has been designed, built and installed at North Carolina State University School of Textiles. This single end machine provides a research facility which makes possible the investigation of the basic phenomena which are involved in the conversion of linear, fiber forming polymers to usable fibers. Break in trials have shown that the equipment is satisfactory for such research. A preliminary study has been made to relate spinnerette hole size to spinning stability and the breaking strength and elongation of yarn produced. Solids content of spinning solutions and temperatures of same, as well as spinning speeds, have been studied as additional parameters. An annotated bibliography on the subject area, covering the period 1940-1966, is given. It is coordinately indexed and converted to a computer based system for purposes of retrieval. Author (TAB)

N70-28543# Grumman Aircraft Engineering Corp., Bethpage, N.Y. Research Dept.
THE OXIDATION OF LiF-COATED REFRACTORY METALS: KINETICS AND CHEMICAL ANALYSIS BY PROTON MICROPROBE ANALYSIS
G. Geschwind and G. M. Padawar Apr. 1970 29 p refs
Presented at the 1969 SAMPE meeting, Los Angeles, 29 Apr. – 1 May 1969
(RM-475J) Avail: CFSTI

A thermogravimetric study of the oxidation in air of LiF coated tantalum was carried out at 700 C and 800 C. The presence of LiF almost completely retarded the oxidation, and a drastic change in kinetics was noted. Similar results were obtained for niobium, and only slightly less protection was afforded tungsten. Since quantitative analysis of the lithium and fluorine distributions by electron microprobe proved impossible, a nuclear microprobe technique was used. This involves bombarding the surfaces of the specimens before and after oxidation with the proton beam of a Van de Graaff accelerator. The Li-7(proton,gamma)Be-8 resonance at 0.441 MeV and the F-19(proton,alpha,gamma)O-16 resonances (doublet) at 0.874 MeV and 0.935 MeV were utilized. The intensity of characteristic gamma radiation and the energy of the incident protons furnished information from which the density distribution of lithium and fluorine as a function of depth could be inferred. Depths as great as 25 microns could be probed with a spatial resolution of approximately 0.1 micron. Author

N70-28549*# TRW Inc., Cleveland, Ohio.
DEVELOPMENT OF HIGH TEMPERATURE OXIDATION RESISTANT COATINGS FOR CHROMIUM-BASE ALLOYS Final Report
H. A. Fisch and J. C. Sawyer 13 Oct. 1969 87 p refs
(Contract NAS3-11173)
(NASA-CR-72673; ER-7397) Avail: CFSTI CSCL 11C

An investigation was conducted to develop coating systems for protecting chromium base alloys from degradation in high temperature air environments. Three coating systems were studied on a Cr-7Mo-2Ta substrate. These were: (1) titanium modified chromium silicide (Cr-Ti-Si) formed directly on the substrate, (2) Cr-Ti-Si formed on an intermediate Cr-MgO barrier layer and, (3) Cr-Ti-Si formed on an intermediate Cr-Y-MgO barrier layer. Based on weight gain after 200 hours of cyclic oxidation testing in air at 2100 F titanium modified chromium silicide coating formed directly on the alloy was the most protective and the Cr-Y-MgO/Cr-Ti-Si the least protective. After 100 and 200 hours exposure, the nitrogen content of the substrate was raised from 0.0022 weight percent to typically 0.008 and 0.010 weight percent respectively. Although nitrogen contamination could be a contributing factor, the increase in bend transition temperature of the substrate from about 540 F to above 1490 F was attributed to an effect of thermal treatment during coating processing. Author

N70-28681# California Univ., Livermore. Lawrence Radiation Lab.
THE LINEAR VISCOELASTIC RESPONSE OF LX-07-1
R. C. Murray and W. G. Moen 18 Sep. 1969 30 p refs
(UCRL-50751) Avail: CFSTI

An experimental program was carried out to characterize the one-dimensional behavior during stress analysis of LX-07-1, a plastic-bonded, high-explosive material with time and temperature dependent mechanical properties. Uniaxial creep tests were performed at different stresses and temperatures to characterize the thermoviscoelastic material. A power-law representation of creep compliance was used to model time dependence. Temperature dependence was characterized using the shifting theory presented by Williams, Landel, and Ferry. The failure envelope concept developed by Smith and Stedry was used as a failure criterion. In all cases, the theories and experimental results were in good agreement. Author

N70-28863# National Aviation Facilities Experimental Center, Atlantic City, N.J.
INVESTIGATION OF ICE ACCRETION CHARACTERISTICS OF HYDROPHOBIC MATERIALS Final Report
Donald M. Millar May. 1970 17 p
(FAA-DS-70-11; FAA-NA-70-2) Avail: CFSTI

To determine their effectivness as antiicing agents, 23 hydrophobic materials were evaluated in a dynamic icing environment. Each substance was examined in a manner that would determine its ice accretion characteristics and ice release properties. No attempt was made to stimulate ice release by either thermal or mechanical means during individual test runs. Ice formed on all the materials which were investigated at the same rate as on the untreated aluminun wing section which was utilized as a test bed. There was no observed release of ice due to aerodynamic forces associated with the test velocities (110 to 150 knots). The minimum ice adhesion force of any product evaluated was 1.8 pounds per square inch, with maximum values in excess of 40 pounds per square inch. Author

N70-28684# Grumman Aircraft Engineering Corp., Bethpage, N.Y. Materials and Structural Mechanics Section.
RETARDATION OF THE OXIDATION OF TANTALUM AND NIOBIUM BY ALKALI HYDROXIDES
G. Geshwind May 1970 15 p refs
(RM-476) Avail: CFSTI

Oxidation of tantalum and niobium powders with various metal hydroxide additions was studied by differential thermal analysis. Retardation of oxidation was observed only in the presence of alkali ions. The degree of retardation decreased as the atomic number of the alkali metal increased, with Li(+) providing the best protection. Results are interpreted in terms of the formation of a mixed alkali-metal-refractor-metal oxide that inhibits further oxidation, while the breakdown of protection may be due to the formation of further mixed metal oxides of lower alkali metal concentration. Author

N70-28727*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
THE PREPARATION AND SPACE ENVIRONMENT BEHAVIOR OF A SILICATE-TREATED ZINC OXIDE THERMAL CONTROL COATING-101
Joe A. Colony May 1970 13 p refs
(NASA-TM-X-63935; X-713-70-194) Avail: CFSTI CSCL 11C

A thermal control coating based on lithium-potassium silicate treatment of zinc oxide was formulated and shown to have a useful shelf-life of six weeks. Tests show that special procedures are necessary to insure adequate adhesion at low temperatures. It is shown from a spectrum of radiation damage experiments that the coating possesses good ultraviolet stability, but can be damaged excessively by high doses of ionizing radiation such as X-rays, electrons, and protons. The usefulness of the coating for thermal control surfaces of spacecraft is limited to missions with minimal exposures to high energy radiation. Author

N70-28729*# Pittsburgh Univ., Pa. Space Research Coordination Center.
DEFORMATION OF THE GROUPS 4-B and 5-B MONOCARBIDES
William F. Brizes (Ph.D. Thesis) 6 Feb. 1970 132 p refs
(Grant NGL-39-011-002)
(NASA-CR-110189; SRCC-117) Avail: CFSTI CSCL 11B

The creep behavior of the Groups IVB and VB carbides was studied in terms of a stress dependent activation energy on one hundred percent dense samples made by liquid state carburization. The stress corrected activation energy for NbC was determined to be 155 kcal per mole in agreement with the estimated activation energy for self-diffusion of niobium in NbC. Internal stresses were determined from stress relaxation measurements and the ratio of the internal stress to the applied stress was 0.78 for steady state creep at 2220 C. For constant strain rate experiments internal stress increased in proportion to the square root of strain. Other properties investigated were thermal expansion, yield stress, and room temperature hardness as a function of stoichiometry. Author

N70-28837# Goodyear Atomic Corp., Piketon, Ohio.
COMPUTER PROGRAMS TO CALCULATE INTERPLANAR SPACINGS AND X-RAY DIFFRACTION LINE INTENSITIES FOR MATERIALS OF KNOWN STRUCTURE
H. H. Thomas and P. L. Daniel 20 Jan. 1970 35 p refs
(Contract AT(33-2)-1)
(GAT-T-1585) Avail: CFSTI

The two computer programs described are used as aids in indexing powder diffraction patterns. They are written in FORTRAN 2 for use on a time sharing system. One program for the calculation of interplanar spacings requires entry of lattice parameters and interaxial angles. Miller indices can be entered by the operator or generated by the computer. The second program calculates relative intensities of diffraction lines. This program requires entry of lattice parameters, multiplicities, fractional atomic coordinates, atomic scattering factors, absorption corrections, and temperature corrections. The use of these two programs is illustrated by sample calculations using original diffraction data of NiF2. The complete calculated pattern, d-values and intensities were compared to the corresponding experimental data. Author (NSA)

N70-28919# Hamburg Univ. (West Germany). Inst. fuer Medizinische Mikrobiologie und Serologie.
ABSORPTION OF MERCURY ORGANIC PRESERVATIVES BY PLASTIC CONTAINERS [ZUR FRAGE DER SORPTION QUECKSILBERORGANISCHER KONSERVIERUNGSMITTEL DURCH KUNST STOFFBEHAELTER]
Herbert Fischer (Ph.D. Thesis) 1969 59 p refs In GERMAN
Avail: CFSTI

The absorption of mercury organic preservatives by plastic containers as well as the seals made from plastomer materials were investigated and different results were obtained. The reasons for these differences are explained and the importance of absorption for the antimicrobial action of preservative solutions is considered. ESRO

N70-28950# Argonne National Lab., Ill.
ELASTIC CONSTANTS OF URANIUM AND PLUTONIUM CARBIDES, NITRIDES AND OXIDES [CONSTANTES ELASTIQUES DES CARBURES, NITRURES ET OXYDES D'URANIUM ET DE PLUTONIUM]
A. Padel and Ch. De Novion Feb. 1970 20 p refs Transl. into ENGLISH from J. Nucl. Mater. (France), v. 33, 1969 p 40-51
Sponsored by AEC
(ANL-Trans-803) Avail: CFSTI

The velocity of sound and the elastic constants of polycrystalline UC, UN, and UO2 at room temperature as function of porosity were measured. Also, the Young's modulus and the internal friction (at the fundamental longitudinal resonance frequency) of UC, UN, UO2, at 25 to 1300 C were measured by resonance techniques. (NSA)

N70-29006*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THERMOPHYSICS RESEARCH AT MSFC
1969 103 p refs Papers presented at Huntsville, Ala., 30 Jan. 1969 *Its* Res. Achievements Rev., Vol. 3, no. 6
(NASA-TM-X-53820; Rept-6) Avail: CFSTI CSCL 11C

Development of various aspects of white thermal control coatings are discussed. A general introduction to thermal control coatings is followed by a more detailed discussion of the present work with paints and pigments for space stable thermal control coatings of low alpha (high reflectance to sun input) and high emissivity in the infrared and low alpha/epsilon radios. Author

N70-29011# Hittman Associates, Inc., Columbia, Md.
SPHERICAL CAPSULE TECHNOLOGY PROGRAM, PHASE 3 Summary Report
Jul. 1969 57 p refs
(Contract AT(29-2)-2475)
(HIT-410) Avail: CFSTI

The analytical and experimental work performed with silver-silica composites in the development of a thermal switch for the Spherical Capsule Technology Program are described. The metal thermal switch concept is presented. Experimental materials and procedures are discussed. The impregnation technique and thermal switch heat treatment method are described. Tests performed to determine the compressive strength, electric resistivity, thermal conductivity, and compatibility of bare and impregnated foam are discussed. Analytical investigations were undertaken to develop heat source configurations using silver-silica composite technology. Both vented and non-vented spherical heat sources and a hemispherically-ended cylindrical heat source were investigated. A thermal model was developed and was used to determine the thermal response of the configurations to aerodynamic reentry heating. The experimental work successfully demonstrated the feasibility of the thermal switch concept at temperatures to about 1800 F using silica ceramic foam. Further analytical work is required to define the optimum heat source configurations in the power range of 650 thermal watts. Author

N70-29062# Atomic Energy Commission Research Establishment, Riso (Denmark).
SOME TECHNOLOGICAL PROPERTIES OF WOOD-PLASTIC MATERIALS
K. Singer, A. Vinther, and Th. Thomassen (Technol. Inst.) Dec. 1969 28 p Prepared jointly with Technol. Inst., Copenhagen
(Riso-211) Avail: CFSTI

Some technological properties of wood-plastic materials are presented. The materials consist of combinations of beech and pine with polymethyl methacrylate, polyvinylacetate and poly(styrene/acrylonitrile). The properties investigated comprise machining and glueing properties, bending strength, hardness, water absorption, and dimensional stability as well as the density and distribution of the polymer in large wood samples. It is concluded that impregnation with polymethyl methacrylate leads to improved properties; poly(styrene/acrylonitrile) increases the hardness.

substantially improves the dimensional stability and gives no great difficulties in machining and glueing; polyvinyl-acetate seems to give no improvements of any appreciable interest. Author (ESRO)

N70-29119# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Mechanical Engineering.
TIRE WEAR MODEL Interim Report, 15 Nov. 1969 - 15 Feb. 1970
Edward Saibel and Chenlung Tsai Feb. 1970 34 p refs
(Contracts NBS CST-845-5; F33615-69-M-5011)
(AD-701254; IR-3) Avail: CFSTI CSCL 13/6

Recent studies on tire wear reveal the importance of mechanochemical processes in highly elastic polymers. Mechanical cleavages of macromolecules have been found to play a very important role, since the free macroradicals formed promote the beginning of complex chemical chain processes, leading ultimately to a profound change in the structure of the macromolecules and the properties of the polymer substances formed from them. Chemical compositions have effect on wear resistance, also environmental conditions affect the wear rate of the tire. Both effects were studied. TAB

N70-29184# Philips Zentrallaboratorium G.m.b.H., Aachen (West Germany).
REFRACTORY PLASTIC OF HIGH STRENGTH AND LOW DENSITY: A NEW COMPACT MATERIAL BASED ON CARBURIZED HIGH POLYMERS [HOCHTEMPERATURFESTER SCHAUMSTOFF VON HOHER FESTIGKEIT UND GERINGER DICHTE: EIN NEUARTIGER VERBUNDWERKSTOFF AUF DER BASIS KARBURIERTER HOCHPOLYMERER]
B. Lersmacher Sep. 1969 23 p In GERMAN Presented at the DGLR Ann. Meeting, Bremen, 22 - 24 Sep. 1969
Avail: CFSTI

It is shown that light carbon materials can be stabilized by forming a second phase in the highly porous foundation. Such stabilization not only increases strength, but under certain circumstances also leads to improved thermal properties or improved oxydation, i.e. corrosion resistance. An example is given of a material having a carbon structure, which was stabilized with a layer of glass-like carbon. A high polymer aerated plastic was impregnated with a lower polymer or monomer carbon-containing fluid such as a phenolic resin solution or furfuryl alcohol, and then given a heat treatment under specified conditions to obtain the stabilized aerated plastic. ESRO

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers.

N70-27877# Stanford Univ., Calif. Dept. of Statistics.
SOME BOUNDED PURSUIT GAMES WITH SIMPLE MOTION. 1: CURVES Technical Report
James Flynn 5 Jan. 1970 28 p refs
(Contract Nonr-225(52))
(AD-701307; TR-153) Avail: CFSTI CSCL 12/2

A pursuer P and an evader E move in the plane with continuous motion P with velocity 1 and E with velocity W = or > 1. Let E be confined to a curve. Suppose that P tries to get as close as possible to E while E tries to keep P as far away as possible, the payoff from P to E being the smallest distance between P and E during the interval of play. This report solves the case where E is confined to a curve of constant curvature (e.g., straight lines and circles). Extensions are probably available for other curves and the results obtained here may help shed light on bounded pursuit games in general. Author (TAB)

N70-27878# Stanford Univ., Calif. Operations Research House.
THE LINEAR COMPLEMENTARITY PROBLEM IN MATHEMATICAL PROGRAMMING Technical Report
B. Curtis Eaves Jul. 1969 90 p refs
(Contracts N00014-67-A-0112-0011; AT(04-3)-326; Grant PHS-GM-789-02)
(AD-701306; TR-69-4) Avail: CFSTI CSCL 12/2

The study centers on the task of efficiently finding a solution of the linear complementarity problem. TAB

N70-27879# Columbia Univ., New York. Operations Research Group.
OPTIMAL REPLACEMENT UNDER MARKOVIAN DETERIORATION Technical Report
Khalish Khanna 15 Dec. 1969 25 p refs
(Contract N00014-67-A-0108-0008)
(AD-701304; TR-48) Avail: CFSTI CSCL 5/1

Consider the problem of determining an optimal replacement policy for a piece of equipment which is subject to Markovian changes of state. The equipment is inspected at discrete time intervals and is classified to be in one of a finite set of states. There is an occupancy cost associated with each of the states. One of the states represents a failure state with an associated penalty cost. On failure the equipment is brought to the new state, by replacement at a cost. On inspection the choice is to replace the equipment or to let it deteriorate in a Markovian manner, the objective being to minimize the expected average cost per period over a long run operation. The principal result is to show that under a general aging property on the stochastic matrix of equipment deterioration and when the state occupancy cost is increasing as the states approach the failure state then only control limit rules are optimal. TAB

N70-27887# Stanford Univ., Calif. Dept. of Computer Science.
LINEAR LEAST SQUARES AND QUADRATIC PROGRAMMING
Gene H. Golub and Michael A. Saunders May 1969 41 p refs
(Contract N00014-67-A-0112-0029)
(AD-700923; CS-134) Avail: CFSTI CSCL 12/2

Several algorithms are presented for solving linear least squares problems; the basic tool is orthogonalization techniques. A highly accurate algorithm is presented for solving least squares problems with linear inequality constraints. A method is also given for finding the least squares solution when there is a quadratic constraint on the solution. Author (TAB)

N70-27897# Toronto Univ. (Ontario). Dept. of Mathematics.
THE NUMERICAL INTEGRATION OF ORDINARY DIFFERENTIAL EQUATIONS Final Report, 1 Oct. 1967 - 30 Sep. 1969
T. E. Hull Sep. 1969 4 p refs
(Grant AF-AFOSR-1357-68)
(AD-702133; AFOSR-70-0631TR) Avail: CFSTI CSCL 12/1

The report describes work performed by the principal investigator in the area of numerical integration of ordinary differential equations from October 1, 1967 to September 30, 1969. Author (TAB)

N70-27930# Pennsylvania State Univ., University Park. Ordnance Research Lab.
EFFECTS OF NON-UNIFORM SAMPLING AND LIMITING ON CORRELATION FUNCTIONS
C. L. Ackerman 13 Aug. 1969 210 p refs
(Contract NOw-65-0123-d)
(AD-700918; TM-676-2341-02) Avail: CFSTI CSCL 9/4

The thesis is a study of nonuniform block sampling theory and its application to the study of correlation functions of sampled signals. The research evolved from the specific problem of reducing the odd harmonic terms that appear in the correlation function of

hard-limited and uniformly sampled sinusoidal signals. These odd harmonic terms arise because of the synchronism between the periodicity of the uniform samples and the periodicity of the odd signal harmonics produced by hard limiting. Nonuniform sampling is used to reduce the periodicity effects and, thus, to reduce the odd harmonic terms in the correlation function. With block sampling, the odd-harmonic correlation-function responses resulting from clipping and sampling can be reduced by any desired degree by the proper choice of sampling parameters. Author (TAB)

N70-27934# Center for Naval Analyses, Washington, D.C.
RESOURCE ALLOCATION IN A SEQUENTIAL FLOW PROCESS
Lester P. Silverman 5 Mar. 1970 27 p refs *Its* Professional Paper No. 21
(AD-702457) Avail: CFSTI CSCL 12/2

A stochastic flow process consisting of several independent sub-process stages is considered. At each stage, a probability density function of time to successful completion of the stage by any of the (assumed homogeneous) process items is a function of parameters which are in turn functions of the budget at which each sub-process is supported (decision variables). The process is generalized to allow for the possibility of auxiliary processing at each stage. The problem is to determine the minimum total budget which will yield a desired confidence in the total process being completed by some deadline. The problem is solved under different assumptions about the functional relationship between expenditures and the resulting improvement in process parameters. The fundamental purpose of the paper is to introduce the concept that, in complex systems, the implications of expenditures often are not known with certainty but can be viewed as altering the nature of the underlying stochastic process. Author (TAB)

N70-27957# Louisiana State Univ., Baton Rouge. College of Engineering.
APPROXIMATE OPTIMAL CLOSED LOOP CONTROL OF NONLINEAR SYSTEMS VIA PARAMETER SEARCH Technical Report
Charles D. Fournier and Frank R. Groves Dec. 1969 30 p refs
(Contract F44620-68-C-0021)
(AD-702086; THEMIS-LSU-T-TR-32; AFOSR-70-0580TR) Avail: CFSTI CSCL 12/1

The purpose of the paper is to present a simple straight-forward procedure for obtaining a near optimal closed loop algorithm for nonlinear system and compare it with linear design via optimal control theory. Author (TAB)

N70-28001# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
A NOTE ON MATRIX RENEWAL FUNCTION
A. M. Kshirsagar and Y. P. Gupta (Delhi Univ.) 23 Jan. 1970 12 p refs
(Contract N00014-68-A-0515; Proj. Themis)
(AD-701687; THEMIS-SMU-TR-55) Avail: CFSTI CSCL 12/1

The Laplace-Steiltjes Transform of the matrix renewal function M(t) of a Markov Renewal process is expanded in powers of the argument s, in this paper, by using a generalized inverse of the matrix I-P sub 0, where P sub 0 is the transition probability matrix of the imbedded Markov chain. This helps in obtaining the values of moments of any order of the number of renewals and also of the moments of the first passage times, for large values of t, the time. All the results of renewal theory are hidden under the Laplacian curtain and this expansion helps to lift this curtain at least for large values of t and is thus useful in applications of Markov Renewal processes to inventory control of repairable items, and to counter theory. Author (TAB)

N70-28002# North Carolina Univ., Chapel Hill. Inst. of Statistics.
A NECESSARY AND SUFFICIENT QUALIFICATION FOR CONSTRAINED OPTIMIZATION
F. J. Gould and Jon W. Tolle Jan. 1970 22 p refs *Its* Mimeo Ser. No. 662
(Contract N00014-67-A-0321-003; Grant AF-AFOSR-1415-68)
(AD-700910) Avail: CFSTI CSCL 12/2

A weak qualification is given which insures that a broad class of constrained optimization problems satisfies the analogue of the Kuhn-Tucker conditions at optimality. The qualification is shown to be necessary and sufficient for these conditions to be valid for any objective function which is differentiable at the optimum. Author (TAB)

N70-28013# Syracuse Univ., N.Y. Dept. of Physics.
THE POINCARE GROUP: LECTURES BY A. P. BALACHANDRAN
D. N. Goswami and M. Modjtehedzadeh Oct. 1969 77 p refs Supported in part by AEC
(SU-1206-212; NYO-3399-212) Avail: CFSTI

The Poincare group is discussed including the topics: the Lie algebra of P, the Lorentz group structure, representation theory of the Poincare group, the reduction of the direct product, felicity, scalar products, and the Jacob – Wick expansion. NSA

N70-28015# Air Force Cambridge Research Labs., Bedford, Mass.
A SPACE: PROPER TIME FORMULATION OF RELATIVISTIC GEOMETRY
R. G. Newburgh and T. E. Phipps, Jr. (Naval Ordnance Lab., White Oak, Md.) Nov. 1969 29 p refs *Its* Phys. Sci. Res. Paper No. 401
(AD-702080; AFCRL-69-0518) Avail: CFSTI CSCL 20/10

Any formulation of the theory of relativity specifies implicitly or explicitly the exactness or inexactness of the temporal and spatial differentials that occur. The Minkowski formulation implicitly assumes the exactness of coordinate (common) time and the inexactness of proper time. In this paper we examine several other possibilities. The assumption of the exactness of proper time and inexactness of common time leads to a space-proper time (SPT) representation of events that (a) yields the customary formal results of the theory including the differential aging prediction of the twin paradox, (b) allows an analog of Fermats principle to describe both particles and light, and (c) leads to a many-proper time formulation of the relativistic many-body problem essentially equivalent to the Minkowski space formulation. Analogies between the SPT geometry and the geometric approach to thermodynamics, especially as formulated by Caratheodory, suggest the gamma function of relativity is an integrating factor with physical meaning for the many-body problem and also provides insight into the concept of virtual photons. Author (TAB)

N70-28016# Stanford Univ., Calif. Dept. of Operations Research.
THE THEORY AND APPLICATIONS OF GENERALIZED LINEAR CONTROL PROCESSES
Zachary F. Lansdowne Feb. 1970 81 p refs
(Contract N00014-67-A-0112-0031; Grant NSF GP-8790)
(AD-702067; TR-10) Avail: CFSTI CSCL 12/2

A nonlinear continuous time optimal control model is formulated which we call a generalized linear control process. In this model the state equations are linear with respect to the state variables, but they are allowed to be nonlinear with respect to the control variables; certain nonnegativity restrictions are also imposed upon the state variables. A theory is developed for this model, including necessary and sufficient conditions for optimality for both finite and infinite planning horizons. Applications of this theory are made to the following problems: a maintenance model for a machine; an investments and operations model of a firm; the Markov decision process with both finite and infinite planning horizons; a hiring and overtime scheduling model of production; and a production and storage model for products subject to breakage, theft, or spoilage. Author (TAB)

N70-28020# Computer Symbolic Inc., Washington, D.C.
USE OF THE ALGEBRAIC THEORY OF MACHINES AND SEMIGROUPS TO PROVIDE GLOBAL INFORMATION OF MACHINE STRUCTURE FROM LOCAL INFORMATION APPLICATIONS TO INFORMATION SYSTEMS AND TO PROBABILISTIC MACHINES Final Technical Report
Oct. 1969 112 p refs (Contract Nonr-4705(00))
(AD-701999) Avail: CFSTI CSCL 12/1

The paper presents an investigation of the relationships between the minimal, global coordinatizations of the type of Krohn and Rhodes and the local coordinatizations of the types of Rees and the determination of the implications of these relationships for information systems and probabilistic machines. TAB

N70-28032# Harvard Univ., Cambridge, Mass. Dept. of Statistics.
A NON-ITERATIVE ALGORITHM FOR LEAST SQUARES ESTIMATION OF MISSING VALUES IN ANY ANALYSIS OF VARIANCE DESIGN Technical Report
Donald B. Rubin 18 Feb. 1970 16 p refs
(Contract N00014-67-A-0298-0017)
(AD-702070; TR-30) Avail: CFSTI CSCL 12/1

An algorithm has been presented for filling in least squares estimates of m missing values. The method is non-iterative and requires only those subroutines already in use by the program designed to handle complete data plus a subroutine to find the inverse of an mxm symmetric matrix. For one missing value, this algorithm is obviously faster than an iterative one, since only two residualizations are needed in order to obtain the exact solution. For m missing values, m + 1 residualizations are needed plus the inversion of the mxm matrix. For many missing values (say, greater than 10), this non-iterative method will probably be slower than an iterative one. However, for any reasonable number of missing values, the extra time involved would probably not be great, especially on third generation computers. In addition, an iterative algorithm does not produce a warning if there is a singular pattern of missing values. The above described non-iterative method should discover the existence of such a pattern when trying to invert R. Work is currently being done to extend the non-iterative approach to insert intelligent least squares missing values in the singular use.
Author (TAB)

N70-28038# Louisiana State Univ., Baton Rouge. Coll. of Engineering.
DYNAMIC PROGRAMMING AND APPROXIMATION IN POLICY SPACE FOR OPTIMAL FEEDBACK CONTROL OF NONLINEAR SYSTEMS
Armando B. Corripo, Cecil L. Smith, and Paul W. Murrill Dec. 1969 37 p refs
(Contract F44620-68-C-0021; Proj. Themis)
(AD-702085; THEMIS-LSU-T-TR-31; AFOSR-70-0581TR) Avail: CFSTI CSCL 7/1

Dynamic programming is used to obtain optimal feedback control policies for time-invariant nonlinear systems with fixed final time. The policy is obtained in the form of a table of the control variable as a function of the state of the system and the time remaining in the process. The recursive relation necessary to obtain the control table is derived for nonlinear systems in general and then used to calculate the optimal temperature schedules for a first order and for a second order batch reactor system. It is shown that approximation in policy space is not needed for the numerical solution of the problem.
Author (TAB)

N70-28042# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.
REDUCING THE RANK OF (A-LAMBDA B) USING THE ROOTS OF A GENERALIZED CHARACTERISTIC POLYNOMIAL
Gerald L. Thompson and Roman L. Weil, Jr. Jan. 1970 15 p refs
(Contract Nonr-760(24); Grant NSF GS-1541)
(AD-700922; RR-192) Avail: CFSTI CSCL 12/1

The rank of the n X n matrix (A - lambda I) is n- J(lambda) when lambda is an eigenvalue occurring in J(lambda) = or > 0 Jordan blocks of the Jordan normal form of A. An analogous expression for the rank of (A - lambda B) is derived for general m X n matrices. When J(lambda) 0, lambda is a rank-reducing number of (A - lambda I). It is shown how the rank-reducing properties of eigenvalues can be extended to m X n matrix expressions (A - lambda B). In particular a constructive way is given for deriving a polynomial P(lambda, A, B) whose roots are the only rank-reducing numbers of (A - lambda B). This polynomial is referred to as the characteristic polynomial of A relative to B.
TAB

N70-28049# RAND Corp., Santa Monica, Calif.
NOTES ON COMBINATORIAL MATHEMATICS: ANTI-BLOCKING POLYHEDRA
D. R. Fulkerson Feb. 1970 53 p refs
(Contract F44620-67-C-0045)
(AD-702431; RM-6201/1-PR) Avail: CFSTI CSCL 12/1

A geometric duality theory of anti-blocking pairs of polyhedra is developed and applied to a number of problems in extremal combinatorics. It is shown that antiblocking pairs are characterized by a min-max equality, the analogue of the max-flow min-cut equality for blocking pairs of polyhedra, or by a max-max inequality, the analogue of the length-width inequality for blocking pairs of polyhedra. A main combinatorial result is that if A, B are (0,1)-matrices defining an anti-blocking pair of polyhedra, then the min-max equality holds for both ordered pairs A, B and B, A in a strong integer form. This theorem bears on a well-known unsolved problem in graph theory, the perfect graph conjecture, and in fact proves what might be called the pluperfect graph theorem.
Author (TAB)

N70-28051# RAND Corp., Santa Monica, Calif.
STABILITY OF THE DUAL CUTTING-PLANE ALGORITHM FOR CONCAVE PROGRAMMING
B. L. Fox Feb. 1970 20 p refs
(Contract F44620-67-C-0045)
(AD-702428; RM-6147-PR) Avail: CFSTI CSCL 12/2

It is shown how to modify the dual cutting-plane algorithm to handle situations where the Lagrangean cannot be maximized (exactly) in a finite number of steps. A geometrical interpretation is presented.
Author (TAB)

N70-28053# Naval Postgraduate School, Monterey, Calif.
RECURSIVE ALGORITHM FOR THE BEST APPROXIMATE SOLUTION OF LINEAR EQUATIONS WITH APPLICATIONS TO SYSTEM IDENTIFICATION AND STATE ESTIMATION
Manfred Hermann Fritz Werther Oct. 1969 145 p refs
(AD-701672) Avail: CFSTI CSCL 12/1

The sequential solution, in recursive form, if a growing set of linear equations, based upon the least-square-error and a weighted least-square-error criterion, are developed. For comparison these results are applied to the discrete-time solution of several estimation and identification problems. Recursive algorithms for pseudo-inversion and the best approximate solution of a set of linear equations are included. Efficient state estimation procedures for time-invariant systems using a sliding-window observer are presented.
Author

N70-28067# Stanford Univ., Calif. Dept. of Statistics.
STATICAL INFERENCE ON TIME SERIES BY RKHS METHODS Technical Report
Emanuel Parzen 20 Jan. 1970 74 p refs
(Contract NONR-225(80))
(AD-701464; TR-14) Avail: CFSTI CSCL 12/1

The theory of time series is studied by probabilists (under such names as Gaussian processes and generalized processes), by statisticians (who are mainly concerned with modelling discrete parameter time series by finite parameter schemes), and by

communication and control engineers (who are mainly concerned with the extraction and detection of signals in noise). The aim of this review is to outline the unifying role of reproducing kernel Hilbert spaces (RKHS) in the theory of time series. There are 13 sections (which are divided into an introduction and 4 chapters). The chapter headings are the following: Time series and RKHS; Parameter estimation and optimization; Examples of RKHS; and Probability density functionals of normal processes. Author (TAB)

N70-28069# RAND Corp., Santa Monica, Calif.
INTERPOLATION ON A NET OF CONVEX QUADRILATERALS
M. A. Kaplan and R. A. Papetti Dec. 1969 39 p refs
(Contract F44620-67-C-0045)
(AD-702432; RM-6221-PR) Avail: CFSTI CSCL 12/1

The problem of forming a surface of interpolation over a mesh of convex quadrilateral cells is investigated. The requirements that the surface be continuous and practical to generate lead to the consideration of interpolation across a space quadrilateral by a set of ruled surfaces. A single surface is selected from this set by use of certain invariance requirements and by simplicity. This surface, an hyperboloid of one sheet, is shown to achieve its maximum and minimum values on its boundary and to have no relative maxima or minima in its interior. The resulting interpolation scheme reproduces the most widely used form of rectangular interpolation in the special case when the quadrilateral is a rectangle. Triangular interpolation is also discussed. Author (TAB)

N70-28110*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A NEW FORMULATION OF CANONICAL PERTURBATION THEORY
David P. Stern May 1970 9 p refs Submitted for publication
(NASA-TM-X-63907; X-641-70-178) Avail: CFSTI CSCL 12A

By means of direct canonical transformations, the Poincare-Von Zeipel perturbation method may be modified into a more useful form. Two particular variants of this approach are examined and explicit formulas are given for carrying them out to at least 4th order. Author

N70-28151# Wisconsin Univ., Madison. Dept. of Computer Sciences.
NONLINEAR TWO-POINT BOUNDARY VALUE PROBLEMS WITH MULTIPLE SOLUTIONS Technical Report
Seymour V. Parter and Victor Pereyra Jan. 1970 43 p refs
(Contract N00014-67-A-0128-0004)
(AD-701884; TR-81) Avail: CFSTI CSCL 12/1

The convergence of finite difference methods are examined in order to approximate the maximal solution of problems of the form: u double prime + lambda f(x,u) = 0, with boundary conditions either u(0) = u(b) = 0 or u(0) = u(b) = 0, 0 < b = < 1. As this problem has in general more than one solution, two algorithms are developed to approximate solutions characterized by the number of their zeros in (0,1). The last section includes numerical results and some additional comments on the implementation of the algorithms on a digital computer. TAB

N70-28212# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
ON CERTAIN PRIORITY QUEUES
Sreekantan S. Nair Dec. 1969 172 p refs *Its* Mimeograph Ser. No. 214
(Contract Nonr-1100(26); Grant NSF GP-7831)
(AD-700289) Avail: CFSTI CSCL 12/2

The thesis deals with three priority queues. Chapters I and II treat a queueing model with two service units in tandem and a single server alternating between them. Chapter III deals with two independent service units with a single server serving alternately between them and Chapter IV treats a single server M/G/1 queue with a priority rule based on the ranking of the service times. In Chapter I the server serves the two service units alternately with a non-zero switching rule in unit 1 and a zero switching rule in unit 2. The case of zero switching rule for unit 1 is dealt in Chapter II. In both cases the distributions of busy period, virtual waiting time and queue length and their ergodic properties are studied in terms of Laplace transforms. In Chapter III we consider the alternating priority queues with a non-zero switching in each unit. Distributions of busy period and queue length are discussed. In Chapter IV we study the virtual waiting time process of an M/G/1 queue under this priority rule: within each generation customers are served in the order of shortest (or longest) service times. Here we also study the limiting behavior of the virtual waiting time, and compare the means of the limiting distributions with those of first come, first served discipline. Applications of the different priority models are discussed. Author (TAB)

N70-28224# Purdue Univ., Lafeyette, Ind. Dept. of Statistics.
OCCAM'S RAZOR NEEDS NEW BLADES
Herman Rubin Dec. 1969 9 p *Its* Mimeograph Ser. No. 216
(Contract N00014-67-A-0226-0008)
(AD-700290) Avail: CFSTI CSCL 12/1

The use of alpha-level tests for fixed alpha is not a valid blade for Occams Razor. In the most important cases of scientific inference, the null hypothesis is known to be false, and consequently the type I error probability is irrelevant. The author points out the lack of an adequate formulation of the problems so that practical solutions can be derived. Author (TAB)

N70-28233# Addis Translations International, Woodside, Calif. Stanford Linear Accelerator Center, Calif.
NONLOCAL QUANTUM FIELD THEORY, NONLINEAR INTERACTION LAGRANGIANS, AND CONVERGENCE OF THE PERTURBATION THEORY-SERIES
G. V. Efimov [1969] 17 p refs Transl. into ENGLISH from the Russian Report Transl. for Stanford Linear Accelerator Center
(SLAC-Trans-108; JINR-P2-4546) Avail: CFSTI

It is shown within the nonlocal quantum theory of one-component scalar field phi, that for an essentially nonlinear interaction Lagrangians L sub 1 (phi), such that L sub 1 (phi) approaches 0 as phi approaches + or − infinity, the nonlocal form factor can be chosen so that S-matrix will be finite, unitary, and macrocausal in each order of perturbation theory, and the whole perturbation series will converge absolutely in the Euclidean region. Author

N70-28234# Wisconsin Univ., Madison. Dept. of Computer Sciences.
NON-LINEAR EIGENVALUE PROBLEMS FOR SOME FOURTH ORDER EQUATIONS. 2: FIXED POINT METHODS Technical Report
Seymour V. Parter Nov. 1969 53 p refs
(Contract N00014-67-A-0128-0004)
(AD-701683; TR-77) Avail: CFSTI CSCL 12/1

Fixed-point theorems are applied to obtain solutions (u sub k(t), theta sub k(t)) of nonlinear fourth order ordinary differential equations of the form u double prime = lambda theta (H sub 1)(t, u, theta), theta double prime = lambda u (H sub 2)(t, u, theta). The solution (u sub k(t), theta sub k(t)) is distinguished by the fact that each function (u sub k(t) or theta sub k(t) has exactly k interior nodal zeros. The basic conditions implying these existence theorems is lambda sub k < lambda < u sub k where lambda sub k and u sub k are the eigenvalues of the linearized problems, linearized about zero and infinity respectively. Author (TAB)

N70-28245*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Mission Analysis Div.
MODELING ERRORS IN KALMAN FILTERS
T. Nishimura 1 Jun. 1970 23 p refs
(Contract NAS7-100)

(NASA-CR-110092; JPL-TR-32-1319) Avail: CFSTI CSCL 12A

Suboptimal filters based on erroneous models of system dynamics as well as on a priori statistics are discussed. Suboptimal estimates for both continuous and discrete cases are derived and the error bounds are established under certain conditions. Two examples are provided to demonstrate the application of the theory developed. Author

N70-28275# Wisconsin Univ., Madison. Dept. of Computer Sciences.

THE METHOD OF CHRISTOPHERSON FOR SOLVING FREE BOUNDARY PROBLEMS FOR INFINITE JOURNAL BEARINGS BY MEANS OF FINITE DIFFERENCES

Colin W. Cryer Dec. 1969 47 p refs

(Contracts DA-31-124-ARO(D)-462; N00014-67-A-0128-0004)

(AD-701681; TR-72) Avail: CFSTI CSCL 12/1

A method for solving free boundary problems for journal bearings by means of finite differences has been proposed by Christopherson. The paper analyses Christophersons method in detail for the case of an infinite journal bearing. First it is shown that the discrete approximation is accurate to O((delta t) squared) where delta t is the stepsize. Next it is shown that the discrete problem is equivalent to a quadratic programming problem. Then the iterative method for computing the discrete approximation is analysed. Finally, some numerical results are given. TAB

N70-28279# Purdue Univ., Lafayette, Ind. Dept. of Statistics.

AN EXACT COMPARISON OF THE WAITINGTIMES UNDER THREE PRIORITY RULES

S. Sreekantan Nair and Marcel F. Neuts Dec. 1969 34 p refs

Its Mimeograph Ser. No. 213

(Contract Nonr-1100(26))

(AD-700288) Avail: CFSTI CSCL 12/2

The waitingtimes of customers under three priority rules are compared. The first is the order of arrival rule. The second is the shortest processing time (within a generation) first and the third is longest processing time (within a generation) first. In particular the covariance matrix of the trivariate distribution of the equilibrium waitingtimes is obtained explicitly. Author (TAB)

N70-28285# RAND Corp., Santa Monica, Calif.

ANOTHER ESTIMATE OF EXPECTED CRITICAL PATH LENGTH IN PERT NETWORKS

John Lindsey, II Mar. 1970 16 p refs

(AD-702673; P-4319) Avail: CFSTI CSCL 5/1

The Program Evaluation and Review Technique (PERT) is a very well-known and widely-applied method for estimating the amount of time required to complete a complex project. The simplest way to estimate the expected time to complete the project is to assume each subtask takes exactly its expected time to complete; and then find a critical path. This procedure, except in very simple cases, gives an underestimate of the true expected time required. In 1962 D. R. Fulkerson published a technique for estimating the expected time required which gives values intermediate between the simplest estimate and the true value. The present paper suggests another technique which, while more complex than Fulkersons method, is more accurate in that it gives estimates which fall between Fulkersons estimates and the true expected value. Author (TAB)

N70-28300# Aerospace Research Labs., Wright-Patterson AFB, Ohio. Applied Mathematics Research Lab.

A TABLE OF THE COMPLETE ELLIPTIC INTEGRAL OF THE FIRST KIND FOR COMPLEX VALUES OF MODULUS, PART 2 Final Report

Henry E. Fettis and James C. Caslin Nov. 1969 259 p ref

(AD-701391; ARL-69-0173) Avail: CFSTI CSCL 12/1

The 11-D values of complete elliptic integral are arranged in tables with R as a parameter and theta as the variable. A nonentry indicated an infinite value. Author

N70-28309# Southeastern Massachusetts Univ., North Dartmouth.

CALCULATION OF HIGH REYNOLDS NUMBER FLOW FIELDS BY NUMERICAL METHODS Final Report, Jun. 1968 - Sep. 1969

Hans U. Thommen Wright-Patterson AFB, Ohio ARL Nov. 1969 29 p refs

(Contract F33615-68-C-1683)

(AD-702144; ARL-69-0194) Avail: CFSTI CSCL 20/4

A variety of numerical methods for the integration of the unsteady Navier-Stokes equations are studied. It is shown that some of the popular methods introduce artificial viscosity terms which, in the steady state approach, may be of the same order of magnitude as the real viscous terms. Consequently, two implicit difference schemes are introduced which do not show this drawback. One of these schemes, which seems to be new, has the advantage of speed and low storage requirements. However, this scheme turned out to be unstable in the case of the Navier-Stokes equations, although it produced excellent results in the case of the scalar Burgers equation. The second scheme, while not basically new, does not seem to have been previously applied. It has the drawback of requiring longer computation times and large storage capabilities. On the other hand, it remained stable and produced accurate results. Author (TAB)

N70-28314# Michigan Univ., Ann Arbor.

ON THE REPRESENTATION OF MARKOVIAN SYSTEMS BY NETWORK MODELS

Victor L. Wallace Aug. 1969 119 p refs

(Contract DA-49-083-OSA-3050; ARPA Order-718)

(AD-702398; SEL-TR-42; TR-21) Avail: CFSTI CSCL 12/2

Formal, unambiguous mathematical structures are developed for representing Markovian queueing networks and for systematically constructing a description of a continuous-parameter Markov chain model from a description of the network diagram. A formal queueing diagram notation is developed as a pictorial language. An approach to the problem decomposition and recomposition of Markovian queueing networks is presented, and applied to realistic queueing networks. Author (TAB)

N70-28318# Wisconsin Univ., Madison. Dept. of Computer Sciences.

THE SOLUTION OF A QUADRATIC PROGRAMMING PROBLEM USING SYSTEMATIC OVERRELAXATION Technical Report

Colin W. Cryer Oct. 1969 23 p refs

(Contract N00014-67-A-0128-0004)

(AD-701682; TR-73) Avail: CFSTI CSCL 12/2

Let A be a real symmetric positive definite n x n matrix and b a real column n-vector. The paper considers the following problem: Find real column n-vectors x and y such that A x = b, (x sup T)y = 0, x > or = 0, y > or = 0. Problems of this type occur when the method of Christopherson is used to solve free boundary problems for journal bearings. In such cases, A is a finite-difference matrix. The paper presents a method for solving the above problem which is a modification of systematic overrelaxation. This method is particularly suitable when A is a finite-difference matrix. TAB

N70-28317# Texas A&M Univ., College Station. Inst. of Statistics.

MIXED CONVEX AND NON-CONVEX PROGRAMMING

H. O. Hartley, M. D. George, and L. R. La Motte Jan. 1970 29 p refs

(Contract N00014-68-A-0140)

(AD-702461; THEMIS-TR-21) Avail: CFSTI CSCL 12/2

In the paper an algorithm is described for solving mixed convex-nonconvex programming problems of the form: minimize f sub 0(x, y) subject to f sub j(x, y) < or = 0, j = 1, ..., k, where x is an n-vector and y is an m-vector and, in addition to some

other mild conditions, for each y, f sub j(x, y), j = 0, ..., k, is a convex function of x. The algorithm consists of an efficient scan of the non-convex (y) space in conjunction with convex programming methods in the convex (x) space to find the global minimum of f sub o with a reasonable amount of computational effort. The algorithm will be practicable only when the number m of non-convex variables is moderate, say m < or = 5. TAB

N70-28323# Institute for Advanced Study, Princeton, N.J.
ALGEBRAIC AND GEOMETRIC STRUCTURES IN CURRENT ALGEBRA THEORY Technical Report
Robert Herman Feb. 1970 75 p refs
(Contract N00014-69-C-0265)
(AD-702075; TR-1) Avail: CFSTI CSCL 12/1

The paper begins the general mathematical study of current algebras by elementary particle physicists. They are defined abstractly as infinite dimensional real Lie algebras, whose underlying vector space is a module over the ring of test-functions. Preliminary remarks about classification of these objects and general geometric and algebraic methods of their construction are made. As preparation, certain facts about differential operators on arbitrary modules are presented. In addition, remarks about the differential-geometric nature of the energy-momentum tensor and conformal symmetry are made. Finally, a global transformation group is constructed whose Lie algebra is one of the simplest current algebras. TAB

N70-28329# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
OPTIMUM PROPERTY OF THE PARTIAL SEQUENTIAL PROBABILITY RATIO TEST Technical Report
Campbell B. Read 15 Jan. 1970 11 p refs
(Contract N00014-68-A-0515)
(AD-701685; THEMIS-SMU-TR-53) Avail: CFSTI CSCL 12/1

(Xn) is a sequence of i.i.d. r.v.s with common p.d.f. P sub theta (.), and tests of H sub 0:theta = theta sub 0 against H sub 1:theta = theta sub 1 are discussed. A Partial Sequential Probability Ratio Test (PSPRT) operates exactly like a Wald SPRT, except that n observations are made before the stopping rule is applied. It is shown that in the class C sub n of test procedures requiring at least n observations, (1) the Bayes risk with fixed losses for wrong decision and fixed cost is minimized by a PSPRT, (2) the boundaries of this PSPRT are those of the Wald SPRT which minimizes the Bayes risk in the class C sub 0, and (3) for all tests having upper bounds alpha and beta on the probabilities of wrong decision, and having finite ASNs, the PSPRT with error probabilities alpha and beta minimizes the ASN at theta = theta sub 0 and theta = theta sub 1. These are the optimum properties which Walds SPRT has in the class C sub 0. Author (TAB)

N70-28338*# Texas A&M Univ., College Station. Inst. of Statistics.
THE EFFECTS OF SERIES TRUNCATION ON ESTIMATES AND THE TRANSFORMATION OF ERRORS Semiannual Status Report
[1970] 10 p refs
(Grant NGR-44-001-095)
(NASA-CR-108409) Avail: CFSTI CSCL 12A

Problems of predicting and measuring the statistical distributions of assembly performances in reliability testing and other engineering designs which employ performance characteristics of constituent parts are considered. The problem is approached by first investigating the effects of Taylor series truncation on the estimation of parameters in the expansion of the multivariate functions of interest. Conditional expectations, Monte Carlo techniques, and standard estimation procedures are given as possibilities for the estimation. The statistical properties resulting from transformations on multivariate functions of random variables are also discussed. Author

N70-28376# National Bureau of Standards, Washington, D.C.
PRECISION MEASUREMENT AND CALIBRATION. VOLUME 1: STATISTICAL CONCEPTS AND PROCEDURES
Harry H. Ku, ed. Feb. 1969 440 p refs
(NBS-SP-300-Vol-1) Avail: SOD $5.50

Papers on precision measurement of specific physical quantities and the calibration of the related metrology equipment are presented. The papers are arranged under the areas of measurement process, design of experiments in calibration, interlaboratory tests, functional relationships, statistical treatment of measurement data, and related topics. For individual titles see N70-28376 to N70-28415.

N70-28380# National Bureau of Standards, Washington, D.C.
SYSTEMATIC ERRORS IN PHYSICAL CONSTANTS
W. J. Youden *In its* Precision Meas. and Calibration, Vol. 1 Feb. 1969 p 56-62 refs (See N70-28376 14-19)
Avail: SOD $5.50

The use of statistical analysis in experimental physics is discussed. Statistical confidence limits that apply to two or three independent determinations of a constant are considered. Emphasis is on what appears to be a plausible explanation for the unexpectedly large differences between the values obtained in different laboratories. Statistical aids for tracking down the causes for disagreement among laboratories are presented. Author

N70-28382# National Bureau of Standards, Washington, D.C.
EXPRESSION OF THE UNCERTAINTIES OF FINAL RESULTS
Churchill Eisenhart *In its* Precision Meas. and Calibration, Vol. 1 Feb. 1969 p 69-72 refs (See N70-28376 14-19)
Avail: SOD $5.50

The uncertainty of a reported value is indicated by stating credible limits to its likely inaccuracy. Different forms of expression are recommended, which will depend on the relative magnitudes of the imprecision and likely bias, and their relative importance in relation to the intended use of the reported value, as well as to other possible uses to which it may be put. Four distinct cases need to be recognized: (1) both systematic error and imprecision negligible, in relation to the requirements of the intended and likely uses of the result; (2) systematic error not negligible; (3) neither systematic error nor imprecision negligible; and (4) systematic error negligible, imprecision not negligible. Specific recommendations with respect to each of these cases are made. General guidelines upon which these specific recommendations are based are discussed. Author

N70-28383# National Bureau of Standards, Washington, D.C.
EXPRESSIONS OF IMPRECISION, SYSTEMATIC ERROR, AND UNCERTAINTY ASSOCIATED WITH A REPORTED VALUE
Harry H. Ku *In its* Precision Meas. and Calibration, Vol. 1 Feb. 1969 p 73-78 (See N70-28376 14-19)
Avail: SOD $5.50

A discussion is given on making the information content of a statement of uncertainty of the result of calibration meaningful, unambiguous, and containing all relevant information. Tables are presented of terms and expressions compiled as a ready reference for those who are searching for appropriate format or wording. The tables cover imprecision, systematic error, and uncertainty statements. Author

N70-28390# National Bureau of Standards, Washington, D.C.
GRAPHICAL DIAGNOSIS OF INTERLABORATORY TEST RESULTS
W. J. Youden *In its* Precision Meas. and Calibration, Vol. 1 Feb. 1969 p 133-137 Repr. from Ind. Quality Control, v. 15, no. 11, May 1959 5 p (See N70-28376 14-19)
Avail: SOD $5.50

A double-sample, graphic analysis scheme is described. The

representation, checking, and interpretation of data are outlined, and the method of estimating the precision of the procedure is given. It is felt that the diagnosis procedure facilitates presentation of results, requires no statistical background, necessitates a minimum of computation, and indicates the presence of errors and erratic work. N.E.N.

N70-28393# National Bureau of Standards, Washington, D.C.
THE COLLABORATIVE TEST
W. J. Youden *In its* Precision Meas. and Calibration, Vol. 1 Feb. 1969 p 151-158 refs Repr. from J. Ass. Offic. Anal. Chem., v. 46, Feb. 1963 8 p Presented at 76th Ann. Meeting of Ass. of Offic. Agr. Chem., Washington, D.C., Oct. 1962
Avail: SOD $5.50

The question of the distribution of the analytical effort is of prime importance. A broad basis for judgment requires enough laboratories and materials to be representative of the users and the materials likely to be submitted for analysis. It is recommended that duplicates be eliminated and reliance placed on the initiating laboratory for information as to the precision of the procedure. Another very important questions concerns the need to make sure that the procedure is really ready for a collaborative test and that it will almost surely pass this final inspection. An efficient and systematic way of disclosing possible weaknesses in the procedure is presented in detail. The initiating laboratory should present evidence of the performance of the procedure when minor and seemingly inconsequential changes are made. Finally a method is described for evaluating unsatisfactory collaborative test results which should be valuable as a guide to determining the probable cause of the unsatisfactory results. Author

N70-28394# National Bureau of Standards, Washington, D.C.
EXPERIMENTAL DESIGN AND ASTM COMMITTEES
W. J. Youden *In its* Precision Meas. and Calibration, Vol. 1 Feb. 1969 p 159-164 refs (See N70-28376 14-19)
Avail: SOD $5.50

Experimental design is discussed from the viewpoint of those concerned with devising and evaluating test procedures. Simple designs are described that make for an efficient approach to the identification of defects in a test procedure. Suggestions are made regarding the supporting evidence that should be offered by an initiating laboratory before conducting an interlaboratory test. A preliminary type of interlaboratory test is advanced as a means of checking on the claims made in behalf of a test procedure. Author

N70-28395# National Bureau of Standards, Washington, D.C.
RANKING LABORATORIES BY ROUND-ROBIN TESTS
W. J. Youden *In its* Precision Meas. and Calibration, Vol. 1 Feb. 1969 p 165-169 refs (See N70-28376 14-19)
Avail: SOD $5.50

For each material the laboratory with the highest numerical result is given the rank of one, the laboratory with the next highest result is given the rank of two, and so on until the lowest result is given the lowest rank (L). A laboratory is scored by summing its ranks for all the materials. A new statistical table that gives lower and upper limits for scores that correspond to 5 percent probability is included. Because systematic errors produce extreme scores, the table should be useful in singling out laboratories with pronounced systematic errors. Author

N70-28396# National Bureau of Standards, Washington, D.C.
THE INTERLABORATORY EVALUATION OF TESTING METHODS
John Mandel and T. W. Lashof *In its* Precision Meas. and Calibration, Vol. 1 Feb. 1969 p 171-178 refs Repr. from ASTM Bull., No. 239, Jul. 1959 9 p (See N70-28376 14-19)
Avail: SOD $5.50

The various sources of variability in test methods are examined, and a new general scheme to account for them is proposed. The assumption is made that systematic differences exist between sets of measurements made by the same observer at different times or on different instruments or by different observers in the same or different laboratories and that these systematic differences are linear functions of the magnitude of the measurements. Hence, the proposed scheme is called the linear model. The linear model leads to a simple design for round robin tests but requires a new method of statistical analysis, geared to the practical objectives of a round robin. The design, analysis and interpretation of a round robin in accordance with the linear model are presented, and the procedure is illustrated in terms of the data obtained in an interlaboratory study of the Bekk smoothness test for paper. Author

N70-28397# National Bureau of Standards, Washington, D.C.
SENSITIVITY: A CRITERION FOR THE COMPARISON OF METHODS OF TEST
J. Mandel and R. D. Stiehler *In its* Precision Meas. and Calibration, Vol. 1 Feb. 1969 p 179-183 refs (See N70-28376 14-19)
Avail: SOD $5.50

To obtain a quantitative measure of merit of test methods, a new concept, sensitivity, is introduced. If M is a measure of some property Q, the sensitivity of M is defined as (dM/dQ)/(standard deviation). It follows from this definition that the sensitivity of a test method may or may not be constant for all values of the property Q. A statistical test of significance is derived for the ratio of sensitivities of alternative methods of test. Unlike the standard deviation and the coefficient of variation, sensitivity is a measure of merit that is invariant with respect to any functional transformation of the measurement, and is therefore independent of the scale in which the measurement is expressed. Author

N70-28399# National Bureau of Standards, Washington, D.C.
EXPERIMENTAL STATISTICS, CHAPTER 5: CHARACTERIZING LINEAR RELATIONSHIPS BETWEEN TWO VARIABLES
Mary G. Natrella *In its* Precision Meas. and Calibration, Vol. 1 Feb. 1969 p 204-249 refs (See N70-28376 14-19)
(NBS-Handbook-91) Avail: SOD $5.50

Physical situations which can be described by linear relationships are considered, and the uses and interpretations of the resulting equations fitted under different models are given. Functional and statistical relationships are discussed in detail, and problems and procedures are presented for each type. N.E.N.

N70-28400# National Bureau of Standards, Washington, D.C.
STUDY OF ACCURACY IN CHEMICAL ANALYSIS USING LINEAR CALIBRATION CURVES
John Mandel and Frederic J. Linnig *In its* Precision Meas. and Calibration, Vol. 1 Feb. 1969 p 250-256 refs Repr. from Anal. Chem., v. 29, May 1957 p 743-749 (See N70-28376 14-19)
Avail: SOD $5.50

In situations characterized by linear calibration curves such as the relation between found and added in studies of accuracy in chemical analysis, the usual method for deriving confidence intervals for the slope and the intercept of the fitted straight line may lead to erroneous conclusions. The difficulty results from the interdependence of multiple conclusions drawn from the same data, especially when there is a strong correlation between the parameters involved. The method of joint confidence regions eliminates these difficulties and has the further advantage of allowing for the evaluation of the uncertainty as the calibration line as a whole, as well as of any values or functions of values derived from it. Author

N70-28402# National Bureau of Standards, Washington, D.C.
THE MEANING OF LEAST IN LEAST SQUARES
Churchill Eisenhart *In its* Precision Meas. and Calibration, Vol. 1 Feb. 1969 p 265-274 refs Repr. from J. Wash. Acad. Sci.,

v. 54, 1964 p 24-33 (See N70-28376 14-19)
Avail: SOD $5.50

An historical account of the development of the least squares method is given. The method was developed from three distinctly different points of view: the least sum of squared residuals of Legendre, in which no probability is involved; the maximum probability of zero error of estimation of Gauss in which normal distribution plays a central and indispensable role; and the least mean squared error of estimation which Gauss showed to be independent of the functional form of the law of error involved when the best values implied by the techniques of least sum of squared residuals are linear functions of the basic observations. Author

N70-28403# National Bureau of Standards, Washington, D.C.
EXPERIMENTAL STATISTICS. CHAPTER 1: SOME BASIC STATISTICAL CONCEPTS AND PRELIMINARY CONSIDERATIONS
Mary G. Natrella and Churchill Eisenhart *In its* Precision Meas. and Calibration, Vol. 1 Feb. 1969 p 277-295 refs (See N70-28376 14-19)
(NBS-Handbook-91) Avail: SOD $5.50

Inductive statistical methods used to generalize from a small body of data to a larger system of similar data are discussed. The fundamental ideas of populations, samples, and distributions are defined. Interpretations are given of some important types of procedures: estimation, confidence intervals, tolerance intervals, and statistical tests of significance. Author

N70-28404*# National Bureau of Standards, Washington, D.C. Inst.for Basic Standards.
STATISTICAL CONCEPTS IN METROLOGY, CHAPTER 2
Harry H. Ku *In its* Precision Meas. and Calibration, Vol. 1 Feb. 1969 p 296-330 refs Repr. from 'Handbook of Industrial Metrology', Am. Soc. of Tool Mfg. Engr., Prentice-Hall, Inc., 1967 p 20-50 (See N70-28376 14-19)
Avail: SOD $5.50

Basic statistical concepts as applied to the description and characterization of a measurement process are presented. A basic kit of tools for the manipulation of measurement data is given, and their use for evaluation of precision is discussed. The use of control chart techniques for monitoring stability is emphasized. Author

N70-28405# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
NOTES ON THE USE OF PROPAGATION OF ERROR FORMULAS
Harry H. Ku *In its* Precision Meas. and Calibration, Vol. 1 Feb. 1969 p 331-341 refs *Its* Paper 70C4-237 (See N70-28367 14-19)
Avail: SOD $5.50

The law of propagation of error is a tool that physical scientists have conveniently and frequently used in their work for many years, yet an adequate reference is difficult to find. An expository review of this topic is presented, particularly in the light of current practices and interpretations. Examples on the accuracy of the approximations are given. The reporting of the uncertainties of final results is discussed. Author

N70-28406# National Bureau of Standards, Washington, D.C.
RANDOMIZATION IN FACTORIAL AND OTHER EXPERIMENTS
E. Bright Wilson, Jr. *In its* Precision Meas. and Calibration, Vol. 1 Feb. 1969 p 342-345 Repr. from 'An Introduction to Scientific Research', Sect. 4.10, McGraw-Hill, 1952 4 p (See N70-28376 14-19)
Avail: SOD $5.50

Two examples illustrating the importance of randomization in experiments are presented. It is stressed that the experimenter cannot take for granted that his data conform to the conditions underlying proper use of statistical techniques. Author

N70-28407# Chicago Univ., Ill.
SOME REMARKS ON WILD OBSERVATIONS
William H. Kruskal *In* NBS Precision Meas. and Calibration, Vol. 1 Feb. 1969 p 346-348 refs (See N70-28367 14-19)
(Contract N6ori-02035)
Avail: SOD $5.50

Nontechnical remarks on detection and treatment of wild or outlying observations are presented. The problems of rejection or inclusion, and if inclusion the most acceptable method, are considered. N.E.N.

N70-28408# National Bureau of Standards, Washington, D.C.
REJECTION OF OUTLYING OBSERVATIONS
Frank Proschan *In its* Precision Meas. and Calibration, Vol. 1 Feb. 1969 p 349-354 refs Repr. from Am. J. Phys., v. 21, no. 7, Oct. 1953 p 520-525 (See N70-28376 14-19)
Avail: SOD $5.50

Two of the modern statistical tests for possible rejection of outlying observations are presented. These two methods apply in a majority of the actually occurring situations and are so easy to use. Author

N70-28411# National Bureau of Standards, Washington, D.C.
ON THE ANALYSIS OF PLANNED EXPERIMENTS
Milton E. Terry *In its* Precision Meas. and Calibration, Vol. 1 Feb. 1969 p 365-367 refs (See N70-28376 14-19)
Avail: SOD $5.50

An example of the use of control charts on residuals is presented. It is felt that the technique, with the aid of recent developments (components of variance, multiple comparisons, and the analysis of residuals) gives answers to questions concerning the validity of statistically planned experiments. N.E.N.

N70-28412# National Bureau of Standards, Boulder, Colo.
OPTIMUM ALLOCATION OF CALIBRATION ERRORS
Edwin L. Crow *In its* Precision Meas. and Calibration, Vol. 1 Feb. 1969 p 368-372 refs (See N70-28376 14-19)
Avail: SOD $5.50

Answers are given to two questions, with emphasis on the second. (1) How do the errors accumulate from echelon to echelon in a hierarchy of calibrations? (2) If a certain accuracy is required at the final echelon of a hierarchy, what is the best way to achieve that accuracy, or, more specifically, what is the optimum allocation of errors among the echelons? The criterion for optimization is taken to be the minimization of the total cost of achieving a given accuracy. Author

N70-28413*# National Bureau of Standards, Washington, D.C.
CONFIDENCE AND TOLERANCE INTERVALS FOR THE NORMAL DISTRIBUTION
Frank Proschan *In its* Precision Meas. and Calibration, Vol. 1 Feb. 1969 p 373-387 refs Repr. from J. Am. Statist. Ass., v. 58, 1953 p 550-564 Presented at Am. Statist. Ass., Boston, Dec. 1951 (See N70-28376 14-19)
Avail: SOD $5.50

Confidence and tolerance intervals for the normal distribution are presented for the various cases of known and unknown mean and standard deviation. Practical illustration and interpretation of these intervals are given. Tables are presented permitting a comparison among the intervals. Finally the relationship between the two types of intervals is described. Author

N70-28414# National Bureau of Standards, Washington, D.C.
THE RELATION BETWEEN CONFIDENCE INTERVALS AND TESTS OF SIGNIFICANCE: A TEACHING AID
Mary G. Natrella *In its* Precision Meas. and Calibration, Vol. 1 Feb. 1969 p 388-391 refs (See N70-28376 14-19)
Avail: SOD $5.50

A discussion is given on the type of information and the advantages of the two methods of treating results. It is concluded that using confidence intervals is often more meaningful and gives a feeling of the uncertainty of experimental evidence. N.E.N.

N70-28415# Ontario Research Foundation, Toronto.
COMPUTATIONS WITH APPROXIMATE NUMBERS
D. B. Delury *In* NBS Precision Meas. and Calibration, Vol. 1 Feb. 1969 p 392-401 refs Repr. from Math. Teacher (Canada), v. 51, no. 7, Nov. 1958 Presented at Ann. Easter Meeting of the Math. and Phys. Sect. of the Ontario Ed. Ass., 1958 (See N70-28376 14-19)
Avail: SOD $5.50

The distinction between approximate numbers and errors of measurement is made, and ways of handling each are discussed. It is pointed out that approximate numbers are concerned specifically with the magnitude of the mistakes that can enter into an arithmetical calculation through truncation of numbers. The concept of range number is considered to have more meaning than that of significant numbers for numberical computation. On the other hand, errors in measurement are concerned with the physical processes of making measurements and are based on empirical evidence about the way measurements behave. These errors should be treated as indicated by the theory of errors, and the program of measurement should be so arranged as to permit the estimation of a standard deviation. N.E.N.

N70-28480# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
EVALUATION OF SIMULATION FROM ITS ABILITY TO SIMULATE COMPONENTS SUBSYSTEMS OF OVERALL SYSTEM
John E. Walsh 23 Jan. 1970 11 p ref
(Contract N00014-68-A-0515; Proj. Themis)
(AD-701688; THEMIS-SMU-TR-56) Avail: CFSTI CSCL 12/2

The report discusses the ability of a random-nature simulation model to represent a system. Operation of the overall system cannot be observed. However, information is available about the operation of some subsystems. These subsystems are such that their operation determines the operation of the overall system. The simulation is considered satisfactory if and only if it has a specified high probability of simulating all of these subsystems to a sufficiently close approximation (during a simulation run). Suppose that, for each subsystem, a criterion has been developed for deciding when the approximation is sufficiently close. This depends on information about the subsystem and its operation. For the evaluation, the simulation model is run a sufficient number of times. A run is considered satisfactory if and only if all the subsystems are simulated sufficiently close. These binomial data are used to investigate whether the model is satisfactory. Homogeneous and independent runs are assumed ordinarily. However, results also can be obtained that apply to heterogeneous runs. These more general results are useful when the simulation is not strictly repetitive (for example, of a man-machine nature). Author (TAB)

N70-28467*# Texas A&M Univ., College Station. Inst. of Statistics.
OPTIMUM INCOMPLETE MULTINORMAL SAMPLES
R. R. Hocking and W. B. Smith Mar. 1970 19 p refs
(Grant NGR-44-001-095)
(NASA-CR-108408; TR-1) Avail: CFSTI CSCL 12A

The problem of designing the data collection procedure to intentionally yield incomplete data but at the same time give desired precision while satisfying certain other requirements is investigated. The problem is considered of minimizing the cost of gathering the data subject to the requirement that the parameters or function of the parameters are estimated with desired precision. For simplicity discussion is restricted to a special class of incomplete data problems but this will serve to illustrate how one might procede in the more general problems. Large sample variances formulas are developed. The minimum cost sample allocation problem and its solution are described and some extensions suggested. Author

N70-28471# Manchester Univ. (England). Statistical Lab.
PiPS SAMPLING DESIGNS AND THE HORVITZ-THOMPSON ESTIMATOR
T. J. Rao Dec. 1969 12 p refs
(RR-16/TJR/1) Avail: CFSTI

Using the criterion of minimum expected variance and the Horvitz-Thompson estimator, various PiPS strategies are studied and a comparison is made between these strategies under a general super-population model. The discussion further motivates the search for a class of designs which are best suited for the use of the Horvitz-Thompson estimator and a new class of such designs is obtained. Author

N70-28493# Mitre Corp., Baileys Crossroads, Va.
A NETWORK ISOLATION ALGORITHM
G. Bennington, S. Lubore, and M. Bellmore (Johns Hopkins Univ.) Dec. 1969 30 p refs Presented at the 35th Natl. ORSA Meeting, Denver, 17 Jun. 1969
(AD-699933; MTP-340) Avail: CFSTI CSCL 12/2

A set of edges D (called an isolation set) is said to isolate a set of nodes R from an undirected network if every chain between the nodes in R contains at least one edge from the set D. Associated with each edge e of the network is a positive cost c(e). The isolation problem is concerned with finding an isolation set such that the sum of its edge costs is a minimum. The paper formulates the problem of determining the minimal cost isolation as a 0-1 integer linear programming problem. An algorithm is presented which applies a branch and bound enumerative scheme to a decomposed linear program whose dual sub-problems are minimal cost network flow problems. Computational results are given. The problem is also formulated as a special quadratic assignment problem and an algorithm is presented that finds a local optimal solution. This local solution is used for an initial bound. Author (TAB)

N70-28498# California Univ., Berkeley. Electronics Research Lab.
NOTE ON FUZZY LANGUAGES
E. T. Lee and L. A. Zadeh Nov. 1969 26 p refs
(Contract DAHC04-69-C-0024)
(AD-701082; ERL-69-7; AROD-8142.2-RT) Avail: CFSTI CSCL 5/7

A fuzzy language is defined to be a fuzzy subset of the set of strings over a finite alphabet. The notions of union, intersection, concatenation, Kleene closure and grammar for such languages are defined as extensions of the corresponding notions in the theory of formal languages. An explicit expression for the membership function of the language L(G) generated by a fuzzy grammar G is given and it is shown that any context-sensitive fuzzy grammar is recursive. For fuzzy context-free grammars, procedures for constructing the Chomsky and Greibach normal forms are outlined and illustrated by examples. Author (TAB)

N70-28550*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A STUDY OF NORDSIECK-TYPE PREDICTOR-CORRECTOR METHODS
Howard M. Eisenike and Allan D. Silver May 1970 31 p refs
(NASA-TM-X-63930; X-641-70-199) Avail: CFSTI CSCL 12A

Predictor-corrector schemes are considered for use as general purpose integrators in solving numerical integration problems on computers. The multistep methods are more advantageous over single step methods because fewer functional evaluations are usually required per integration step. The Nordsieck method, which is equivalent to one of the multistep methods, is investigated to determine its feasibility as a general purpose technique. R.B.

N70-28578# Los Alamos Scientific Lab., N.Mex.
INTERSECTION OF A RAY WITH A SURFACE OF THIRD OR FOURTH DEGREE
E. D. Cashwell and C. J. Everett Sep. 1969 9 p refs
(Contract W-7405-eng-36)
(LA-4299) Avail: CFSTI

It has become desirable to include, in the geometric subroutine of Monte Carlo programs, a procedure for finding the intersections of a line of flight with a toroidal surface. Such problems, for surfaces of third or fourth degree, depend in an obvious way on the solution of cubic or quartic equations. Although the latter subject is centuries old, a careful exposition of its details required for machine computation is given. A routine is then derived for solution of the required torus-intersection problem. Author

N70-28598# Midwest Research Inst., Kansas City, Mo. Energetics Research Lab.
DERIVATIVE-FREE ITERATION PROCESSES OF HIGHER ORDER
Jet Wimp Nov. 1969 19 p refs
(Contract F33615-69-C-1564)
(AD-700776; ARL-69-0183) Avail: CFSTI CSCL 12/1

Two different iteration processes are derived for determining a root alpha of the equation x = psi(x) where psi is analytic in a neighborhood of alpha. The methods do not contain derivatives of psi and are of arbitrary order m. They reduce to Steffensens iteration procedure when m = 2. Author (TAB)

N70-28614*# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
ON BEHAVIOR STRATEGY SOLUTIONS OF FINITE TWO-PERSON CONSTANT-SUM EXTENDED GAMES
Feb. 1970 36 p refs
(Grants NGL-15-005-021; AF-AFOSR-1776-69; NSF GK-1970)
(NASA-CR-110184; TR-EE-70-9) Avail: CFSTI CSCL 12A

Through the introduction of a concept called recall-sensitivity, it is demonstrated that perfect recall (each player remembers all of his past actions and past knowledge of the other player's and nature's actions) is a sufficient but not a necessary condition for the existence of behavior strategy solutions in finite two-person constant-sum extended games. A method is presented by which behavior strategies meeting a necessary condition for solutions may be generated. Comments are made on the practical implications of the material presented. Author

N70-28625*# Illinois Univ., Urbana. Antenna Lab.
REMOTE PROBING METHOD FOR THE DETERMINATION OF THE PROFILE OF INHOMOGENEOUS MEDIA
D. Schaubert and R. Mittra May 1970 41 p refs
(Grant NGR-14-005-009)
(NASA-CR-110012; UILU-ENG-70-302; SR-15; Rept-70-7) Avail: CFSTI CSCL 12A

The problem of determining the permittivity of a medium from a knowledge of the electromagnetic fields scattered by the medium is considered. A nonlinear integral equation is derived for the dielectric profile, which is a function of only one variable. The solution of this equation by an iterative scheme is investigated. An alternate formulation of the problem, which leads to a linear integral equation, is also studied. In both cases, the numerical solutions to these problems are unstable, i.e. they are highly sensitive to small errors. The second method leads to a uniqueness proof for the inversion process. Author

N70-28639# Manchester Univ. (England). Statistical Lab.
HORVITZ-THOMPSON AND DES RAJ ESTIMATORS REVISITED
T. J. Rao Apr. 1970 10 p refs
(RR-18/TJR/2) Avail: CFSTI

It is shown that in the generalized pi PS sampling strategy, consisting of the design with pi sub i, the probability of inclusion of the ith unit in the sample, proportional to the modified size together with the corresponding Harvitz-Thompson estimator, is superior to the symmetrized Des Raj strategy under a general super-population set-up for all values of the super-population paramater g. Author

N70-28640# Aberdeen Research and Development Center, Aberdeen Proving Ground, Md.
CONFIDENCE INTERVAL ESTIMATION OF THE RELIABILITY OF MULTICOMPONENT SYSTEMS USING COMPONENT TEST DATA
Jerome R. Johnson Nov. 1969 39 p refs
(AD-699809; ARDC-TR-3) Avail: CFSTI CSCL 14/4

A method is developed for the construction of confidence intervals for a general class of functions of binomial parameters called system reliability functions. These system reliability functions express the reliability of a multicomponent system as a function of the reliabilities of the components of the system. The method derived uses the exact multivariate binomial distribution of component test data. The problem is formulated as a general mathematical programming problem and numerical methods are developed for the solution of the problem. The method is applied to several specific systems and detailed computational procedures are developed for each. The method derivad is compared with other currently available methods for constructing confidence intervals for system reliability based on component test data and the results of this comparison indicates the possibility of obtaining and appreciable reduction in the average length of confidence intervals for a given sample size and confidence coefficient by the use of the method of this report. The use of these confidence intervals for the construction of statistical tests of hypotheses concerning system reliability is also discussed. Author (TAB)

N70-28642# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A NEW METHOD FOR SOLVING THE HILBERT BOUNDARY VALUE PROBLEM FOR SEVERAL UNKNOWN FUNCTIONS
N. P. Vekua 21 Oct. 1969 10 p refs Transl. into ENGLISH from Akad. Nauk Gruzinskoi SSR, Soobshch. (Tiflis), v. 52, no. 1, 1968 p 17-20
(AD-700788; FTD-HT-23-438-69) Avail: CFSTI CSCL 12/1

A new method is presented for solving a homogeneous Hilbert problem by reducing it to a new system of Fredholm integral equations which is obtainable in a way comparatively simpler than by the Plemelj system. The homogeneous Hilbert problem considered is given. The following theorem is proved: if the connected problem does not have vanishing-in-the-infinity solutions, the obtained equation can be solved, and each solution of this equation yields a definite solution of the problem considered. A procedure is outlined for constructing a canonical system for solving the Hilbert problem. Author (TAB)

N70-28655# Manchester Univ. (England). Statistical Lab.
ON A CHARACTERISATION OF CERTAIN INFINITELY DIVISIBLE POSITIVE DEFINITE FUNCTIONS AND MEASURES
K. Schmidt Dec. 1969 13 p refs
(RR-15/KS/1) Avail: CFSTI

A positive definite function in two variables on a locally compact group, written as the product of two positive definite functions of a single variable is classified as a product-type. H is proved that a product-type positive definite function, which is also of product-type after being subjected to automorphism of its domain of a certain kind, is infinitely divisible. On second countable abelian groups an analogous result is true for measures, and as a generalization of a result of C. R. Rao, these measures turn out to be Gaussian. Author

N70-28660*# Rice Univ., Houston, Tex.
TECHNIQUES, BASED ON EXTREMAL SUBSPACES, FOR IMPROVED RECONSTRUCTION OF SIGNALS FROM SAMPLES
R. G. Meier and T. W. Parks [1970] 8 p ref
(Grant NGL-44-006-033)
(NASA-CR-110216) Avail: CFSTI CSCL 12A

Suppose a signal drawn from a known class of signals is subject to a finite set of linear functionals, or generalized "samples". The problem of estimation of the sampled signal through linear reconstructions based on these measurements is considered. The extent to which a sampling scheme can determine members of a given signal class is measured by the worst-case error in reconstructing the signals from their samples. Two reconstruction techniques, based on extremal subspaces, are developed. Error bounds are presented and compared with reconstruction in sampling subspace. Finally, to provide a concrete example of this general theory, the results are applied to a much-studied class, the class of time-concentrated, bandlimited signals. The measurement process is here assumed to be the "convenient" one of Nyquist rate time-sampling. For this problem, plots of the error bounds and of several test functions and their reconstruction are presented, both for the proposed algorithms, and for conventional "cardinal sampling theorem" reconstruction. Author

N70-28677# Rice Univ., Houston, Tex.
GENERAL TECHNIQUE FOR SOLVING NONLINEAR, TWO-POINT BOUNDARY-VALUE PROBLEMS VIA THE METHOD OF PARTICULAR SOLUTIONS
A. Miele and R. R. Iyer 1969 34 p refs
(Grant NSF GP-18522)
(AAR-63) Avail: Issuing Activity

A general technique for solving nonlinear, two point boundary value problems is presented; it is assumed that the differential system has order n and is subject to p initial conditions and q final conditions, where p + q = n. The differential equations and the boundary conditions are linearized about a nominal function x(t) satisfying the p initial conditions. The linearized system is imbedded into a more general system by means of a scaling factor alpha, 0 = or < alpha = or < 1, applied to each forcing term. The method of particular solutions is employed in order to obtain the perturbation delta x(t) = alpha A(t) leading from the nominal function x(t) to the varied function x(t); this method differs from the adjoint method and the complementary function method in that it employs only one differential system, namely, the nonhomogeneous, linearized system. Author

N70-28691# Lyon Univ. (France). Inst. of Nuclear Physics.
A GRAPHICAL TREATMENT OF WICK'S THEOREM
Jacques Meyer, Jacques Sau, and Jean-Noeel Massot 5 Jan. 1970 22 p refs
(LYCEN-7001) Avail: AEC Depository Libraries

A graphical method is used to rearrange a sequency of annihilation and creation operators in order to obtain systematically all the terms given by the Wick's theorem. An application of this method is given for the calculation of a commutation relation. Author (NSA)

N70-28703# Manchester Univ. (England). Statistical Lab.
INFINITELY DIVISIBLE PROJECTIVE REPRESENTATIONS, COCYCLES AND LEVY-KHINCHINE-ARAKI FORMULA ON LOCALLY COMPACT GROUPS
K. R. Parthasarathy and K. Schmidt Mar. 1970 51 p refs
(RR-17/KRP/4/KS/2) Avail: CFSTI

In certain problems of quantum field theory it is necessary to define the notion of a continuous tensor product of representations of some groups. In attempts to construct such tensor products previous investigators have introduced the notion of factorizable and infinitely divisible representations. To every factorizable representation Araki associates a cocycle of first order with values in a Hilbert space. An attempt has been made in this investigation to establish a one to one correspondence between the cocycles and infinitely divisible projective representations. Cocycle equations have been derived by considereing certain stochastic processes, and as a consequence a certain representation theorem for conditional s-positive definite functions has been developed. This yields the classical Levy-kinchine formula for the Fourier transform of an infinitely divisible distribution of a locally compact abelian group. For a Lie group a formula is obtained for conditional positive definite functions in terms of the cocycles. This has been designated as the Levy-Khinchine-Araki formula. A.L

N70-28709# Pittsburgh Univ., Pa. Dept. of Mathematics.
COMPLETE CONTINUITY OF THE INVERSE OF THE LAPLACIAN AND GREEN'S FUNCTION
James P. Fink Jan. 1970 16 p refs
(Contract AT(30-1)-3829)
(NYO-3829-46) Avail: CFSTI

The theory of strictly positive definite operators and completely continuous symmetric operators on a Hilbert space is applied to certain boundary value problems in mathematical physics. The application to the eigenvalue problem for the vibrating membrane is discussed in detail. (NSA)

N70-28722# Minnesota Univ., Minneapolis. School of Statistics.
PLAY-THE-WINNER RULE AND INVERSE SAMPLING FOR SELECTING THE BEST k = OR > 3 BINOMIAL POPULATIONS
Milton Sobel and George H. Weiss Jul. 1969 25 p refs Sponsored in part by NIH
(Grant NSF GP-9018)
(TR-126) Avail: Issuing Activity

The effect of the play-the-winner (PW) sampling rule when used with different termination rules for selecting the best of k independent binomial populations has already been considered for k = 2. The best population is defined to be be the one with the highest probability p of success on a single trial. When K > or = to 3 the population A is sampled until a failure is observed, then you switch to (say) B and keep on with B until its first failure, and then switch to C and observe C until its first failure; the cycle then gets repeated and when one of the players gets r successes, stop and select it as best. At the outset randomization is used, i.e., order (for sampling) the 3 populations giving probability 1/6 to each possible ordering. Author

N70-28761# Sandia Corp., Albuquerque, N. Mex.
MINIMAL UNIFORM COVERS ON FINITE SETS
Gustavus J. Simmons Dec. 1969 108 p refs Sponsored by AEC
(SC-RR-69-486) Avail: CFSTI

By using the result that there exist infinitely many integers m > or = to r such that r and N are arbitrary positive integers, it is shown that for a fixed q and r and for all n sufficiently large no proper subset of the r sets can be a uniform cover. For q = n - 1 and r arbitrary, all of the minimal uniform covers are found and shown to contain n/(n,r) r-sets. The weight of these covers is n-r/(n,r). For q = n - 2, it is shown that the existence of a balanced incomplete block design implies the existence of a uniform cover; however, the converse is not true. Necessary and sufficient conditions are given for the converse to hold. The combinatorial identity proven in this paper is used to show that the row sums of the product of the incidence matrix of any uniform cover C with the q-sets and the incidence matrix of its image under any permutation alpha epsilon S is the same as C x C. The essential parameters are computed for all minimal uniform covers 10 > or = to n > or = to q > or = to r > or = to 1 with the single exception of n = 10, q = 7, r = 5 for which no solution could be found. These values are tabulated. Author

N70-28767# Minnesota Univ., Minneapolis. School of Statistics.
A NOTE ON THE SOLUTIONS OF TWO RECURSIVE RELATIONS
A. Hadian and Milton Sobel Sep. 1969 4 p refs
(Grants NSF GP-9018; NSF GP-11021)
(TR-127) Avail: Issuing Activity

The solutions of two recursive relations by mathematical applications are discussed. Group testing, ranking of numbers by binary comparisons, and other related problems are presented. Author

N70-28774*# North Carolina State Univ., Raleigh.
THE LINEAR TIME OPTIMAL CONTROL PROBLEM FROM A CALCULUS OF VARIATIONS POINT OF VIEW
Lawrence M. Hanafy Washington NASA Jun. 1970 21 p refs
(Grant NGL-34-002-032)
(NASA-CR-1612) Avail: CFSTI CSCL 12A

The linear time optimal control problem is transformed into a Lagrange problem by means of a mapping which takes a closed control region into an open one. Then the problem and a particular example thereof are investigated in light of the classical necessary and sufficient conditions in the calculus of variations. Author

N70-28798*# Maryland Univ., College Park. Computer Science Center.
NUMERICAL CONSTRUCTION OF THE HILL FUNCTIONS
Jitka Segethova Apr. 1970 46 p refs
(Grant NGL-21-002-008)
(NASA-CR-110183; TR-70-110) Avail: CFSTI CSCL 12A

In the theory of approximation of functions and solution of ordinary or partial differential equations functions are often approximated by finite sums. A numerical construction of these functions is presented. An algorithm with reasonable stability is designed using local coordinates and an expansion in Legendre polynomials. Two possible local coordinate systems are shown and discussed. Some remarks about the accuracy of results are stated. Tables of coefficients of the functions up to order 10 in both local coordinate systems are included as well as the graphs of these functions and a FORTRAN 4 version of an algorithm. Author

N70-28822*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.
PERMEABILITY OF A ONE-DIMENSIONAL POTENTIAL BARRIER
R. J. Le Roy, K. A. Quickert (Toronto Univ.), and D. J. Le Roy (Toronto Univ.) 31 Mar. 1970 30 p refs
(Grant NGL-50-002-001)
(NASA-CR-110198; WIS-TCI-384) Avail: CFSTI CSCL 12A

A numerical method is described for computing the exact permeability for any one dimensional potential barrier. It is used to test the validity of the widely used approximate formulas for the tunneling factors for truncated parabolic barriers. The method is also used to calculate tunneling factors for the H + H2 exchange reaction, using the theoretical potential surface of Shavitt, Stevens, Minn, and Karplus, and it is shown that standard Eckart and parabolic barrier approximations can yield considerable error. Author

N70-28851# New York Univ., N.Y. AEC Computing and Applied Mathematics Center.
THIRD ORDER DIFFERENCE METHODS FOR HYPERBOLIC EQUATIONS
Samuel Z. Burstein Arthur Mirin Dec. 1969 53 p refs
(Contract AT(30-1)-1480)
(NYO-1480-136) Avail: CFSTI

A class of differences schemes is proposed for hyperbolic problems in one and two space dimensions. The methods are applicable to nonlinear initial value problems, they are uniformly third order accurate on both the space variables and time, and are similar to methods proposed by other authors. Author

N70-28877# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md. R. E. Gibson Library.
REPRESENTATION OF FUNCTIONS BY ORTHOGONAL SERIES
R. I. Osipov 31 Oct. 1969 23 p refs Transl. into ENGLISH from Mat. Sb. (Moscow), v. 68, no. 4 p 487 - 497
(Contract NOw-62-0604-c)
(AD-700419; APL-CLB-3-T-613) Avail: CFSTI CSCL 12/1

The author proves the following theorem on the basis of a direct construction of the functions (phi sub n)(x). Let summation from n = 1 to n = infinity of ((a sub n)squared) = + infinity and let F(x) be an arbitrary measurable function, with extended real values, on (0,1). Then there exists an orthonormal system (phi sub n)(x) with the property that each rearrangement of the series summation of ((a sub n)(phi sub n)(x)) converges almost everywhere to F(x). Author (TAB)

N70-28894# Midwest Research Inst., Kansas City, Mo.
THE GAMMA FUNCTION Technical Progress Report, 1 Mar. - 15 Jun. 1969
Yudell L. Luke 7 Jul. 1969 21 p refs
(Contract AT(11-1)-1619)
(COO-1619-9; TPR-9) Avail: CFSTI

Each of two forms of the incomplete gamma function can be evaluated by sequences of Pade approximations qua a function of the variable z for a given value of the parameter mu. Effective asymptotic error representations are developed. How to combine Pade approximations to evaluate gamma(mu + 1) f for complex nu. Author

N70-28925# Oak Ridge National Lab., Tenn.
ADEQUATE SAMPLE SIZES FOR RANDOMIZED BLOCK DESIGNS
Marvin A. Kastenbaum, David G. Hoel, and K. O. Bowman Feb. 1970 46 p refs
(Contract W-7405-eng-26)
(ORNL-4527) Avail: CFSTI

Techniques described in an earlier report are used to generate tables of sample size requirements for testing treatment effects in a randomized block design. Maximum values of the standardized range of the treatment means are tabulated for k = 2(1)6 treatments; b = 2(1)5 blocks; N = 1(1) 30(2) 50(5) 100 observations per cell; and alpha = 0.01, 0.05 and beta = 0.005, 0.01, 0.025, 0.05, 0.1, 0.2, 0.3, 0.4 levels of risk. Author (NSA)

N70-29003# Nationaal Lucht-en Ruimtevaartlaboratorium, Amsterdam (Netherlands).
HIGH-ORDER ACCURACY NUMERICAL INTEGRATION OF SECOND-ORDER ORDINARY DIFFERENTIAL EQUATIONS BY MEANS OF NORDSIECK'S METHOD
C. R. Traas 1969 53 p refs
(NLR-TR-69040-U) Avail: CFSTI

An investigation was performed to obtain a reliable and economical method for the numerical integration of second order ordinary differential equations of considerable complexity over a long interval. A Nordsieck process of 10th order was selected, and a derivation of the process is given. Stability and accuracy have been thoroughly studied and the numerical results are compared with those of the 9th order Adams - Moulton process and of a 5th order Runge - Kutta type process. Author (ESRO)

N70-29148# Texas Univ., Austin. Electronics Research Center.
A SENSITIVITY ALGORITHM FOR THE KALMAN FILTER AND PREDICTOR
Demetrios G. Lainiotis and Malcolm R. Railey Feb. 1970 31 p refs
(Grant AF-AFOSR-1764-69)
(AD-701427; AFOSR-70-0399TR) Avail: CFSTI CSCL 9/4

In this investigation sensitivity matrix algorithms for the continuous-time Kalman filter and predictor are derived. Nonlinear matrix differential equations of the Riccati type are derived. The

solutions of these equations represent the increase in the error covariance matrix of a suboptimal estimator over the optimal estimator. These solutions permit the sensitivity analysis to be performed a priori on linear estimation problems. The objective of this investigation was to provide the designer a technique to simplify the sensitivity analysis of the Kalman filter and predictor. Author (TAB)

N70-29162# American Micromation Industries, Inc., Philadelphia, Pa.
PARTIAL DERIVATIVE EQUATIONS OF MATHEMATICAL PHYSICS
H. Poincare. Dec. 1969. 100 p. Transl. into ENGLISH from Am. J. Math., v. 17, 1890 p 28-294. Prepared for BNL
(BNL-tr-313) Avail: CFSTI

The Dirichlet problem is constructed to find the final temperature of a solid conducting body, which is homogeneous and isotropic, when the different points on the surface of the body are artificially maintained at given temperatures. The same problem is applied to find the distribution of the static electricity at the surface of a given conductor. Other analogies are cited for differential equations from the same family which are applicable to static or dynamic electricity, heat propagation, optics, elasticity, or hydrodynamics. NSA

N70-29167# Stanford Univ., Calif. Dept. of Statistics.
A BOUND ON THE CLASSIFICATION ERROR FOR DISCRIMINATING BETWEEN POPULATIONS WITH SPECIFIED MEANS AND VARIANCES
Herman Chernoff. 5 Jan. 1970. 17 p refs
(Contract Nonr-225(72))
(AD-701361; TR-66) Avail: CFSTI CSCL 12/1

Given two univariate distribution functions F sub 1 and F sub 2 with means and variances mu sub 1, mu sub 2, (sigma sub 1) squared, (sigma sub 2) squared, Becker((1968), Recognition of Patterns, Polyteknisk Forlag, Copenhagen) has proposed S = (absolute value of (mu sub 1- mu sub 2))/(sigma sub 1 + sigma sub 2) as a measure of separability of F sub 1 and F sub 2. He has conjectured that of all pairs F sub 1, F sub 2 with specified means and variances, the worst pair using one-sided tests based on a single observation yields an error probability of (2(1 + S squared)) exp (-1) when F sub 1 and F sub 2 are equally likely. In this paper the conjecture is verified and a related conjecture is shown to apply equally well to the likelihood ratio test. Author (TAB)

N70-29185# Saclant ASW Research Center, La Spezia (Italy).
THE NUMERICAL EVALUATION OF A CERTAIN INTEGRAL WITH A RAPIDLY OSCILLATING INTEGRAND
Hans R. Krol and Brian W. Conolly. 15 Mar. 1970. 25 p refs
(TM-150) Avail: CFSTI

The numerical evaluation of integrals of the form integral from 0 to t of e to the (alpha s) power sin 2 omega sub 0 s (sq d + sq (Y sub 0-vs)) to the -(3/2) power ds by two methods. The first is conventional. The second is unconventional and exploits the possibility of expanding the expression in parenthesis in terms of Legendre polynomials. Author (ESRO)

N70-29194# Wisconsin Univ., Madison.
NONEXISTENCE OF A CONTINUOUS RIGHT INVERSE FOR SURJECTIVE LINEAR PARTIAL DIFFERENTIAL OPERATIONS WITH CONSTANT COEFFICIENTS Technical Report
David K. Cohoon. Jan. 1970. 50 p refs
(Contract N00014-67-A-0128-0014)
(AD-701718) Avail: CFSTI CSCL 12/1

Let P(D) denote a linear partial differential operator with constant coefficients of positive degree. Let V(P) denote the vector space spanned by the characteristics of P(D) and let dim V(P) denote its dimension. For P(D) having independent variables, it was shown that P(D) has no continuous right inverse for any open subset. Also under a suitable nonhyperbolicity hypothesis it was shown that P(D) had no continuous right inverse. These nonexistence results are extended for varying conditions of V(P) satisfying additional hypothesis that every characteristic hyperplane which meets the vertex meets the base. Author

N70-29201# Army Natick Labs., Mass.
PROBABILITY OF DEFECTIVE ASSEMBLIES WHEN COMPONENT TOLERANCES ARE INCORRECT
Lance W. Jayne and Edward W. Ross, Jr. Dec. 1969. 57 p refs
(AD-701863; Rept-70-46-OSD) Avail: CFSTI CSCL 14/4

The report describes an investigation of how errors in components of an assembly can affect its performance. In particular the report deals with the situation, uncommon in engineering practice, where the output tolerance of the assembly may be violated even though the tolerances on the components are all met. This situation is analyzed to estimate the probability that the output tolerance will be satisfied given that the component tolerances are met. Three methods are described for estimating this probability, their results are compared in a number of cases, and a best method is chosen. Several simple rules, suitable for preliminary estimates, are also given. An example is worked out showing a simple application of the method. Author (TAB)

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N70-27886# Air Force Global Weather Central, Offutt, AFB, Nebraska.
EVALUATING PROBABILITY FORECASTS Technical Memo
James S. Kennedy and Preston G. Epperson. 15 Dec. 1969. 14 p refs
(AD-701375; AFGWC-TM-69-4)

The accuracy of an aggregate of probability forecasts involves two basic attributes which are called reliability and sharpness. By expanding the equation of the Brier-Allen Probability Score, consistent definitions of reliability and sharpness are derived in which the correlation coefficient between forecasts and outcomes has a key role. Presented is a graphic means of comparing aggregates of probability forecasts in terms of their reliability and sharpness. Author (TAB)

N70-28035# Air Force Cambridge Research Labs., Bedford, Mass. Aerospace Instrumentation Lab.
TEST REPORT: AN/GMD-2A RAWIN SET-AN/FPS-16 RADAR COMPARISON
Bernard D. Weiss and Elefterios J. Georgian. Nov. 1969. 42 p refs *Its* Instrumentation Papers No. 162
(AD-701009; AFCRL-69-0522) Avail: CFSTI CSCL 4/2

The report presents an operational evaluation of the accuracies of the Rawin Set AN/GMD-2A. The analysis presented is based on data generated by 24 radiosonde flights conducted at both low and high elevation angle conditions. Two radar sets (AN/FPS-16) tracking a corner reflector attached to the radiosonde train were used as the standard for comparison. Author (TAB)

N70-28080# Danish Meteorological Inst., Charlottenlund.
METEOROLOGICAL YEARBOOK, 1962. PART 1: DENMARK AND FAROE ISLANDS (EXCEPT GREENLAND) [METEOROLOGISK ARBOG, 1962. DEL 1: DANMARK OG FAEROERNE (UNDTAGEN GRONLAND)]
1969. 92 p. In DANISH and ENGLISH

Avail: CFSTI

Daily, monthly, and annual summaries from approximately 462 stations are presented including air pressure, temperature, wind, humidity, precipitation, cloudiness, and meteorological phenomena. A list of the climatological and precipitation stations is included. Meteorological tables, and climatic maps of Denmark constitute the bulk of the report. E.M.C.

N70-28093# United Kingdom Atomic Energy Authority, Harwell (England). Health Physics and Medical Div.

RADIOACTIVE FALLOUT IN AIR AND RAIN: RESULTS TO THE MIDDLE OF 1969

R. S. Cambray, E. M. Fisher, W. L. Brooks, and D. H. Pierson Nov. 1969 52 p refs

(AERE-R-6212) Avail: AEC Depository Libraries; HMSO 7s; BIS $1.40

Samples of atmospheric dust and rainwater have been collected from the United Kingdom and elsewhere. Results are presented of analyses of these samples for various fission products and certain other radionuclides. The concentrations of the long-lived fission products Cs-137 and Sr-90 in air in the United Kingdom were, in the first half of 1969, about 90% of those for the first half of 1968; the deposition and concentration in rainwater were about 75% of those in 1968. The Chinese explosion of 27th December 1968 contributed about 70% of the long-lived activity in the summer of 1969; the remaining 30% was divided between the Chinese explosion of 17th June 1967 and older debris. Measurements in air in the southern hemisphere show that, in mid-1969, about 75% of the long-lived activity was contributed by the French tests held in the South Pacific in 1968. An estimate is made of the world-wide deposition of Sr-90 in rain to the end of 1968. Author (NSA)

N70-28095*# National Weather Records Center, Asheville, N.C.

SURFACE CLIMATOLOGICAL INFORMATION FOR TWELVE SELECTED STATIONS FOR RE-ENTRY VEHICLES

Russel F. Lee, Grant W. Goodge, and H. L. Crutcher Feb. 1970 102 p

(NASA Order H-76789)

(NASA-CR-61319) Avail: CFSTI CSCL 04B

Space vehicle re-entry requires climatological and meteorological information for advanced planning as well as operational activity. Selected climatological summaries for twelve specified locations are presented, any one of which may be needed as an alternate at one time or another. A short narrative precedes the tabular summaries. Monthly and annual temperature-precipitation summaries are given. The monthly and annual summaries of specified weather conditions are also shown. The report was prepared to provide background information for use in trade-off studies on the NASA space shuttle operational and abort landing requirements relative to atmospheric conditions at several selected locations. At least one station was selected for each continent. Each station included in the study has an airport runway > or = to 8000 feet. Author

N70-28123*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.

NEAR INFRARED LIGHT SCATTERING BY TERRESTRIAL CLOUDS

James E. Hansen and James B. Pollack (Cornell Univ., Ithaca, N.Y.) [1970] 63 p refs

(NASA-TM-X-62906) Avail: CFSTI CSCL 04B

Calculations of the reflectivity of water clouds (liquid and ice particles) are compared to observations of terrestrial clouds in the near infrared. Mie scattering calculations of general interest; comparison of multiple scattering results to cloud observations; a revision in the optical constants of ice for lambda approximately equal to 3 micron and the details of several methods which substantially reduce the work load in multiple scattering computations are included. Our results indicate that it is possible to use the spectral variation of the reflectivity to derive the size of the cloud particles and their phase (liquid or solid) as well as the total optical depth of the clouds. Typical results show dense cirrus clouds to have an optical depth > or = to 10 and to be composed of ice particles of mean radius 15-20micron; the cumulus clouds which were analysed showed a more variable, but usually smaller, particle size. In spectral regions where the single scattering albedo is high it is found that most of the gas absorption takes place within the clouds rather than above them. Author

N70-28147# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE OPERATION OF APPARATUS FOR DETERMINING THE LOCATION OF NEARBY THUNDERSTORM FOCI

T. V. Lobodin et al 31 Oct. 1969 14 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 225, 1968 p 30-34

(AD-702130; FTD-MT-24-281-69) Avail: CFSTI CSCL 4/1

Errors in recording the azimuths of thunderstorm discharges and the selection of the operating regime of the amplitude analyzers in the apparatus, which consists of a location finder with two frame antennas set up at some distance from each other, are examined. The maximum error in the determination of the azimuth sferics is shown to be the sum of given elements. In evaluating the distance of the nearest thunderstorm discharge on the basis of the amplitude distribution of sferics it is necessary to harmonize the requirements for the detailing of the scale with increase of the indeterminacy arising as a result of the overlapping of the readings of neighboring counters of thunderstorm discharges. The calculations made show that in practice (tolerable overlapping of the readings of neighboring indicators within the limits of 20-30 percent) by using a distance block with six indicators it is possible to maintain the following scale: 25, 50, 100, 170, 270 and 400 km. The operation of the sixth indicator shows that thunderstorms are present at a distance less than 40 km, the operation of the fifth indicator shows the presence of thunderstorms at a distance less than 270 km, etc. Author (TAB)

N70-28173# Air Force Systems Command, Wright-Patterson AFB, Ohio. Air Force Flight Dynamics Lab.

THE SCIENTIFIC OBJECTIVES, PHILOSOPHY, AND MANAGEMENT OF THE MOCAT PROJECT Final Report, 10 Jan. - 15 Apr. 1969

John A. Dutton Dec. 1969 152 p refs

(AD-702160; AFFDL-TR-69-96) Avail: CFSTI CSCL 4/1

The time has come for a thorough investigation of the physics of clear air turbulence (CAT) in order to fulfill the needs of both the aeronautical and scientific communities for improved understanding of this phenomenon. The report shows how the MOCAT project can be organized to fulfill this objective, and that there is sufficient understanding of CAT so that the project can be planned for maximum effectiveness. Present knowledge about CAT shows that it is likely that it is a manifestation of the Kelvin-Helmholtz instability. The correspondence of the implications of this hypothesis and the tendency for CAT to occur in internal fronts (baroclinic layers) is emphasized. A detailed analysis of the instrumentation requirements combines acceptable error in the final measurements and known characteristics of CAT to determine acceptable RMS errors in the basic measurements such as airspeed, pitch, yaw, and roll angles, and inertial platform velocities. An organizational structure which will simplify project management and increase the likelihood of success is proposed. The plan attempts to delineate responsibility for segments of the program according to the natural divisions which occur in the scientific and engineering communities. Author (TAB)

N70-28174# Weather Wing (1st), San Francisco, Calif.

FEBRUARY CLIMATE OF SOUTHEAST ASIA Final Report

Feb. 1970 68 p *ltr* Special Study 105-11/2

(AD-701748) Avail: CFSTI CSCL 4/2

The report deals with the climate of North Vietnam, Republic of Vietnam, Laos, Cambodia, and Thailand for February. It is essentially based on previously available data; however, precipitation analyses, ceiling/visibility, and upper air flow are new. It contains brief notes on the climate of Southeast Asia and the geographical features of the Republic of Vietnam, North Vietnam, Cambodia, Laos, and Thailand. It discusses the precipitation, thunderstorms, cloudiness, visibility and obstructions to vision, combined ceiling/visibility, temperature, relative humidity, surface and upper winds, miscellaneous phenomena and sea operations. A station locator and topography map is included. TAB

N70-28222# Weather Wing (1st), San Francisco, Calif.
MARCH CLIMATE OF SOUTHEAST ASIA Final Report
Feb. 1970 69 p Supersedes AD-478064
(AD-701749; WWSS-105-11/3) Avail: CFSTI CSCL 4/2

The report deals with the climate of North Vietnam, Republic of Vietnam, Laos, Cambodia, and Thailand for March. Essentially based on previously available data, however, precipitation analyses, ceiling/visibility, and upper air flow are new. Contains brief notes on the climate of Southeast Asia and the geographical features of the Republic of Vietnam, North Vietnam, Cambodia, Laos, and Thailand. Discusses the precipitation, thunderstorms, cloudiness, visibility and obstructions to vision, combined ceiling/visibility, temperature, relative humidity, surface and upper winds, miscellaneous phenomena and sea operations. Contains a station locator and topography map. Also included are charts of mean position of polar front and ICZ (1:17,000,000) typhoon tracks (1:10,000,000), sea surface currents, temperatures, frequency of breakers, sea swell (1:10,000,000). Monthly sunrise, sunset, morning and evening twilight data are presented for Saigon with method for adapting to other stations. Author (TAB)

N70-28232# Air Force Global Weather Central, Offutt AFB, Nebraska.
TROPICAL WIND AND TEMPERATURE ANALYSIS
August L. Shumbera, Jr. 22 Dec. 1969 20 p refs
(AD-702449; AFGWC-TM-69-5) Avail: CFSTI CSCL 4/2

The AFGWC objective computer tropical wind and temperature analysis program produces gridded wind and temperature analyses from 850-50mb. The analysis technique is the method of successive correction to a first guess field. First guess fields are derived from persistence, climatology and a blending of gridded data from the Northern Hemisphere upper air analysis program. Validated wind and temperature observations are used to correct the first guess fields in the analysis. The correction formula effectively treats all aircraft observations over a small area as one composite observation and all fixed observations as another composite observation which prevents several aircraft observations from masking out an observation from a fixed station. A special technique is used to eliminate spurious divergence in the wind analyses. Author (TAB)

N70-28284# RAND Corp., Santa Monica, Calif.
ATMOSPHERIC MODELING, FIELD PROGRAMS, AND DECISION SYSTEMS
F. W. Murray Mar. 1970 16 p refs
(AD-702672; P-4315) Avail: CFSTI CSCL 4/2

The interrelation between field programs and atmospheric modeling is discussed in the context of studies of weather modification. In particular, numerical models of convective clouds are considered. It is shown how activities in both field programs and modeling affect decisions concerning each other, culminating in the use of models for day-to-day go, and no go decisions concerning the field programs. This talk was prepared for the Sixth Skywater Conference, sponsored by the Bureau of Reclamation in Denver, 10-11 February 1970. Author (TAB)

N70-28299# Air Weather Service, Offutt AFB, Nebr. Global Weather Central.
A DATA SELECTION PROCEDURE FOR THE RECTIFICATION AND MAPPING OF DIGITIZED DATA
Richard C. Roth 1 Dec. 1969 28 p ref
(AD-701374; AFGWC-TM-69-1) Avail: CFSTI CSCL 4/2

The report describes an automated method for the rectification and mapping of meteorological satellite image information or similar high resolution data. The particular purpose for developing this procedure is to rectify and map meteorological satellite photographs and spin scan data with the greatest possible accuracy. The emphasis of the procedure is on data selection. The described procedure is in contrast to the data placement approach of direct mapping. A data selection method is described in detail and is shown to be superior to direct mapping in terms of accuracy, efficiency and speed. Author (TAB)

N70-28334 Freie Univ., Berlin (West Germany).
METEOROLOGICAL DATA. VOLUME 105, NO. 4: BERLIN DATA: DIGITAL AND ANALOG RESULTS OF THE CENTRAL DATA RECORDING INSTALLATION AND REMOTE INSTRUMENTS FOR 1969 Quarterly Report [METEOROLOGISCHE ABHANDLUNGEN. BAND 105, HEFT 4: BERLINER MESSUERTE: DIGITALE UND ANALOGE ERGEBNISSE DER ZENTRALEN MESSWERTREGISTRIERANLAGE UND WEITERER INSTUMENTE FUER DAS JAHR 1969. TEIL 4, 4. VIERTELJAHR]
Richard Scherhag, Erich Wedler et al 1969 361 p In GERMAN
(QR-4) Avail: CFSTI

Digital and analog data are presented for daily observations of atmospheric pressure, wind direction and velocity, air temperature, dew point, relative humidity, vapor pressure, precipitation, radiation, and atmospherics in the Berlin, Germany region for the fourth quarter of 1969. Corrections and supplements to the data are also provided. Transl. by R.B.

N70-28443* Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie und Geophysik.
METEOROLOGICAL DATA. VOLUME 101, NO. 11: RESULTS FROM THE SYNOPTIC SERVICE FOR THE YEAR 1969. DAILY WEATHER CHARTS (GROUND 500 mb, 300 mb) AND BRIEF SCIENTIFIC STUDIES, NOVEMBER 1969 [METEOROLOGISCHE ABHANDLUNGEN. BAND 101, HEFT 11: ERGEBNISSE DES SYNOPTISCHEN DIENSTES IM JAHRE 1969. TAEGLICHE WETTERKARTEN (BODEN, 500 mb, 300 mb) UND KLEINERE WISSENSCHAFTLICHE AUFSAETZE, NOVEMBER 1969]
Richard Scherhag et al 1969 182 p In GERMAN
Avail: CFSTI

Daily synoptic weather maps are presented for ground, 500-mb, and 300-mb levels over the Northern Hemisphere during November, 1969. Each map contains height and temperature plots and corresponding contours. Measurements of precipitation, temperature, and radioactivity over Berlin, Germany are listed. Studies on weather prediction for middle Europe and meteorological observations from jet aircraft flights over the tropical Atlantic are also included. Transl. by R.B.

N70-28446# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md. R. E. Gibson Library.
RADAR STUDIES OF HAIL PROCESSES IN MOLDAVIA
C. S. Voronov et al 23 Sep. 1969 14 p refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 4, 1969 p 48-53
(Contract NOw-62-0604-c)
(AD-700359; APL-CLB-3-T-610) Avail: CFSTI CSCL 4/2

The meso-characteristics of hail and shower clouds are presented. Values of radar and temperature parameters are determined, together with a complex criterion for the degree of danger of formation of hail clouds for several months of the warm half-year. Author (TAB)

N70-28499# Joint Publications Research Service, Washington, D.C.

A METHOD OF REDUCING THE BLIND ZONE OF WEATHER RADAR

S. I. Vaksenburg et al. 15 May 1970. 12 p. refs. Transl. into ENGLISH from Tr. Tretyego Vses. Soveshch. po Radiolokatsionnoy Meteorol. (USSR), no. 3, 1968 p. 230 - 237
(JPRS-50528) Avail: CFSTI

The problems involved in determining the lower cloud boundary are discussed with respect to the MRL-1 two-range meteorological radar operating in a vertical scanning mode. The cloud cover boundary can be determined at some distance from the station during scanning in the vertical plane because of the high resolution of the station in angle of elevation in the millimeter channel. The side lobe effect of the antenna must be eliminated while retaining normal response in the direction of the main lobe in order to determine the lower cloud boundary. R.B.

N70-28582# Deutscher Wetterdienst, Hohenpeissenkarg (West Germany). Meteorologisches Observatorium.

RESULTS OF 1967 AEROLOGICAL OZONE SOUNDINGS AND TOTAL AMOUNT OF OZONE MEASUREMENTS AT THE HOHENPEISSENBERG METEOROLOGICAL OBSERVATORY Final Report, Oct. 1968 - Oct. 1969

Walter Attmannspacher. Oct. 1969. 191 p.
(Contract DA-91-591-EUC-3852)
(AD-701922; ARDG(E)-D-1093) Avail: CFSTI CSCL 4/1

Vertical profiles of the atmosphere during periods of thunderstorm and frontal activity are being studied under this contract. This report covers ozone soundings in 1967 at the Hohenpeissenberg Meteorological Observatory. The semi-automatic method of evaluating the frequency recordings of the sonde was used. Raw data were processed on the Siemens 2002 computer of the Hahn-Meitner Institute of Berlin, for time, pressure and humidity sondes. Ozone raw data were processed at Deutscher Wetterdienst, Offenbach/Main. From 11 July 1967 onward, the total ozone content obtained from each ozone sonde ascent was compared with the respective values measured by the Dobson spectrophotometer and was corrected, as necessary. Ozone sondes were launched on each geophysical day of a week. The report presents results in tables and ozonograms. Author (TAB)

N70-28601*# Radiation Research Associates, Inc., Fort Worth, Tex.

A COMPARISON OF CALCULATED AND MEASURED INTENSITIES OF SUNLGHT REFLECTED BY THE EARTH'S ATMOSPHERE

C. Thompson and M. B. Wells. 1 Mar. 1970. 69 p. refs.
(Contract NAS2-5285)
(NASA-CR-110090; RRA-T703) Avail: CFSTI CSCL 04B

Calculations were performed to investigate the application of a computer procedure, RRA-89, to the computation of the irradiance received by a satellite. RRA-89 calculations of the total intensity of 0.37 and 0.78 micron wavelength light at a satellite positioned over a clear maritime atmosphere were found to be in good agreement with calculations performed with the FLASH Monte Carlo procedure that treats a spherical shell atmosphere. LITE-II Monte Carlo calculations were run to determine the effect of changes in the type of surface albedo on the reflected radiation at the top of the atmosphere. LITE-II calculations were run to determine the effect of cloud optical thickness on the reflected radiation. Comparisons were made of the reflected intensities computed for a maritime atmosphere containing clouds with measured data from the Tiros satellite. LITE-II calculations were run to determine the intensity of the atmospheric reflected sunlight from clear and cloudy maritime and clear continental atmospheres for wavelengths of 0.37, 0.45, 0.54, 0.67, and 0.78 micron. These data were compared with OSO-III measurements for the save wavelength. The agreement found between the calculated and measured data is sufficiently close to warrant the conclusion that most problems involving the reflected radiation from the earth's atmosphere can be solved using the LITE-II data with the RRA-89 procedure. Author

N70-28659*# Boeing Co., Huntsville, Ala. Aerospace Group.

A STATISTICAL SAMPLING PROCEDURE FOR JIMSPHERE WINDS ALOFT POPULATION

Charles H. Carlisle. 2 Feb. 1970. 58 p.
(Contract NAS8-5608)
(NASA-CR-61324; D5-15800) Avail: CFSTI CSCL 04B

The large amount of available Jimsphere wind data necessitates the reduction of this information to a relatively small set of analytical probabilistic structures. This task has been accomplished for the time average power spectral density (PSD) of Jimsphere scalar wind profiles. These Jimsphere wind profile data were acquired at the Kennedy Space Center, Florida. It is shown that the distribution of PSD at a fixed wave length is well fitted by a gamma distribution and that the mean and square root of the variance of this distribution are essentially exponential functions of wave number. Sampling distributions on the mean as well as confidence intervals are obtained and the rate of convergence to normal sampling distributions is discussed. It is concluded that the time average PSD has a simple tractable probabilistic structure at all wave lengths between 100 m and 4000 m. Author

N70-28679# National Environmental Satellite Center, Washington, D.C.

ESTIMATING MEAN RELATIVE HUMIDITY FROM THE SURFACE TO 500 MILLIBARS BY USE OF SATELLITE PICTURES

Frank J. Smigielski and Lee M. Mace. Mar. 1970. 16 p. refs.
(ESSA-TM-NESCTM-23) Avail: CFSTI

An experimental method was developed for estimating atmospheric relative humidity by using satellite cloud photographs. The method used and subsequent operational procedures are described. Author

N70-28690# Environmental Technical Applications Center (Air Force), Washington, D.C.

US NAVAL WEATHER SERVICE WORLD-WIDE AIRFIELD SUMMARIES. VOLUME 8, PART 8: UNITED STATES OF AMERICA SOUTHEAST REGIONS

Feb. 1970. 390 p. refs.
(AD-701719) Avail: CFSTI CSCL 4/2

The report is part of a series of compilations which is world-wide in scope. It consists of climatological summaries for selected airfields of the Southeastern region of the United States. Author (TAB)

N70-28724# Joint Publications Research Service, Washington, D.C.

NUMERICAL EXPERIMENTS IN MODIFYING THE KINETICS OF CLOUD SPECTRUM FORMATION BY INTRODUCING ADDITIONAL CONDENSATION NUCLEI

Yu. S. Sedunov. 15 May 1970. 11 p. refs. Transl. into ENGLISH from Tr. Inst. Eksp. Meteorol. GUGMS (USSR), no. 6, 1969 p. 3 - 9
(JPRS-50525) Avail: CFSTI

A mathematical discussion is presented on the effects of additional nuclei on the initial condensation stage, or drop formation, with supersaturation and concentration parameters varied. Results show that additional nuclei always lead to an increase in the total number of drops formed. This in turn can lead to more highly dispersed distribution and to greater colloidal stability of the clouds. Results also show that maximim effect will occur if the nuclei have minimal activity and convert into drops on reaching maximum supersaturation. Finally, the effective radius is determined not only by the physical-chemical properties of the nucleus itself but also by the external parameters such as vertical velocity and the distribution function of the natural nuclei. N.E.N.

N70-28730# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md. R. E. Gibson Library.

SPACE-TIME CHARACTERISTICS OF CLEAR-SKY RADAR RETURNS

G. B. Brylev et al. 10 Nov. 1969 25 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 217, 1967 p 76 - 87
(Contract NOw-62-0604-C)
(AD-700421; APL-CLB-3-T-617) Avail: CFSTI CSCL 4/2

The space-time characteristics of coherent clear-sky radar returns, obtained from a layer of the atmosphere 150 m thick, over various time intervals at altitudes from 1 to 2 km are examined. An analysis of the statistical breakdown of the radar returns is made. It is shown that the sizes of the zones of enhanced radar reflectivity are as much as 300 m vertically and 1-6 km horizontally.
Author (TAB)

N70-28868# Institut Royal Meteorologique de Belgique, Brussels. Regie des Voies Aeriennes et Force Aerienne.

SYNOPTIC OBSERVATIONS Monthly Bulletin, Nov. 1968 [OBSERVATIONS SYNOPTIQUES]

1969 28 p In FRENCH and DUTCH
Avail: CFSTI

Data derived from synoptic measurements made at different Belgian weather stations during November 1968 are tabulated.
ESRO

N70-28869# Institut Royal Meteorologique de Belgique, Brussels. Regie des Voies Aeriennes et Force Aerienne.

SYNOPTIC OBSERVATIONS Monthly Bulletin, Dec. 1968 [OBSERVATIONS SYNOPTIQUES]

1969 30 p In FRENCH and DUTCH
Avail: CFSTI

Data derived from synoptic measurements at different Belgian weather stations during December 1968 are tabulated.
ESRO

N70-28913# Institut Royal Meteorologique de Belgique, Brussels.

CLIMATOLOGICAL OBSERVATIONS Monthly Bulletin, Mar. 1970 [OBSERVATIONS CLIMATOLOGIQUES]

1970 16 p In FRENCH and DUTCH
Avail: CFSTI

Climatological data derived from observations made at the Royal Institute for Meteorology, Uccle (Belgium) in March 1970 are given.
ESRO

N70-28951# Sandia Corp., Albuquerque, N.Mex. Library Operations Div.

CONCERNING THE STRUCTURE OF PRECIPITATIONS. 3: RAIN IN THE ARCTIC, TEMPERATE, AND TROPICAL ZONES

M. Diem 20 Feb. 1970 45 p Transl. into ENGLISH from Arch. Meteorol., Geophys. Bioklimatol., Ser. B (Vienna), no. 16, 1968 p 347 - 390 Sponsored by AEC
(SC-T-70-4006) Avail: CFSTI

The structure of precipitation, which has been measured at eight stations distributed from the polar to the tropic zone, is mainly determined by the atmospheric stratification and by the geographical situation. Characteristic variations could be found at the different stations, which show up in the number of drops within the various classes of drop sizes or in the range of the spectrum. Rains caused by barrage or by lability are distinctly different. Intense rains are combined with lability and high temperature and, therefore, are absent in the polar zone. They appear only with broad spectra and are bound to large numbers of drops only in the tropics. Between an ideal rainfall and a really measured one there are always differences on account of the drops of different sizes which always appear.
Author (NSA)

N70-29000# Meteorologisches Observatorium, Hohenpeissenberg (West Germany).

RESULTS OF THE SPECIAL PLUVIOGRAPH NETWORK IN 1969 [ERGEBNISSE DES REGENSCHREIBER-SONDERNETZES IN JAHRE 1969]

Dec. 1969 56 p In GERMAN *Its* Sonderbeobachtungen Des Meteorol. Obs. Hohenpeissenberg No. 5
Avail: CFSTI

In the framework of a special project of the Deutsche Forschungsgemeinschaft (German Research Community) a network of 46 pluviographs (Hellmann-Fuess type; 24-hour drum revolution) was set up in an area of 1000 sq km north of Hohenpeissenberg. Results of the registrations during 1969 are given as tables.
ESRO

N70-29029# Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie und Geophysik.

AEROLOGICAL BALLOON ASCENTS AT BERLIN [AEROLOGISCHE HOCHAUFSTIEGE IN BERLIN]

E. Maedlow *In* Deut. Forschungsgemeinschaft Intern. Quiet Sun Yr. (IQSY) 1964/65 1969 5 p In GERMAN (See N70-29026 14-13)
Avail: CFSTI

During the past decade balloons were capable of ascending to rocket altitudes up to 60 km. Tables are given of the types, costs, and maximum altitudes of several balloons. Use of standard US Weather Service radiosondes with additional hypsometers and radiotheodolites gave reliable measurements, even at extreme altitudes. Stratospheric temperature profiles before, during, and after the IQSY period were also determined.
ESRO

N70-29030# Meteorologisches Observatorium, Hohenpeissenberg (West Germany).

ASCENTS WITH SPECIAL RADIOSONDES AT THE HOHENPEISSENBERG OBSERVATORY [AUFSTIEGE MIT SPEZIALRADIOSONDEN AM OBSERVATORIUM HOHENPEISSENBERG]

W. Attmannspacher *In* Deut. Forschungsgemeinschaft Intern. Quiet Sun Yr. (IQSY) 1964/65 1969 3 p In GERMAN (See N70-29026 14-13)
Avail: CFSTI

During the latter part of the IQSY high altitude balloon ascents were made during geophysical world intervals each Monday, Wednesday and Friday, and also daily during the period March 8th - 21st. American hypsometersondes were used and winds were determined up to the balloon ceiling. Thermistors were tested during good weather ascents in a sonde carrying a Wheatstone bridge measuring air temperatures to 0.1 C.
ESRO

N70-29032# Meteorologisches Observatorium, Hohenpeissenberg (West Germany).

OZONE ASCENTS IN 1965 AND THE FOLLOWING YEARS AT THE HOHENPEISSENBERG OBSERVATORY [OZONAUFSTIEGE 1965 UND IN DEN FOLGENDEN JAHREN AM OBSERVATORIUM HOHENPEISSENBERG]

W. Attmannspacher *In* Deut. Forschungsgemeinschaft Intern. Quiet Sun Yr. (IQSY) 1964/65 1969 5 p In GERMAN (See N70-29026 14-13)
Avail: CFSTI

An ozonosonde with a chemiluminescent rhodamin B dye element was first used but was later replaced by a Brewer sonde. A relation between ozone profiles and temperature profiles over the period 1965 to 1967 is discussed.
ESRO

N70-29033# Technische Hochschule Aachen (West Germany). Forschungsstelle fuer Geophysik und Meteorologie.

DISCUSSION ON ATMOSPHERIC ELECTRICITY NEAR THE GROUND [DISKUSSION UEBER BODENNAHE LUFTELEKTRIZITAET]

H. Israel *In* Deut. Forschungsgemeinschaft Intern. Quiet Sun Yr. (IQSY) 1964/65 1969 2 p refs In GERMAN (See N70-29026 14-13)
Avail: CFSTI

Atmospheric electricity investigations near the ground were not very successful during the IQSY because the use of mean values masks the intricate phenomena. Future synoptic observations and maximum station separations are discussed.
ESRO

N70-29034# Deutscher Wetterdienst, Hamburg (West Germany). Meteorologisches Observatorium.

THE RADIATION BALANCE AND ITS COMPONENTS [DIE STRAHLUNGSBILANZ UND DEREN KOMPONENTEN]

R. Schulze *In* Deut. Forschungsgemeinschaft Intern. Quiet Sun Yr. (IQSY) 1964/65 1969 13 p In GERMAN (See N70-29026 14-13)

Avail: CFSTI

Polyethylene lupolen-H, made by the BASF firm, is used by the German Weather Service to measure the radiation balance of the earth's surface. Hourly sums of the radiation balance and its components for the period 1955 to 1964 are discussed. ESRO

N70-29035# Deutsche Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.

RADIATION RADIOSONDES AND SCATTERED LIGHT MEASUREMENTS [STRAHLUNGSRADIOSONDEN UND STREULICHTMESSUNGEN]

H. G. Mueller *In* Deut. Forschungsgemeinschaft Intern. Quiet Sun. Yr. (IQSY) 1964/65 1969 2 p ref In GERMAN (See N70-29026 14-13)

Avail: CFSTI

Radiosondes for solar and celestial radiation and the reflection of short-wave radiation from the earth's surface and clouds (albedosondes), as well as for terrestrial and atmospheric thermal radiation (infraredsondes) were developed and used on a large scale during the IQSY. Author (ESRO)

N70-29036# Tubingen Univ. (West Germany). Astronomisches Inst.

RESULTS OF SOUNDINGS OF ATMOSPHERIC ELECTRICITY ABOVE LAND AND SEA [ERGEBNISSE DER LUFTELEKTRISCHEN SONDIERUNGEN VON LAND UND VON SEE AUS]

R. Muehleisen *In* Deut. Forschungsgemeinschaft Intern. Quiet Sun Yr. (IQSY) 1964/65 1969 8 p In GERMAN (See N70-29026 14-13)

Avail: CFSTI

A method was developed for the precise determination of the voltage between the ionosphere and Earth during 1954, and the electric field strength was measured with balloon radiosondes as a function of altitude. The ionospheric voltage was determined by integration. Ionospheric potential values as well as atmospheric electric field strength values over the oceans were representative for the global atmospheric electric circuit, so proving Wilson's (1920) theory of the global atmospheric electric circuit. ESRO

N70-29037# Hamburg Univ. (West Germany) Meteorologisches Inst.

THE ATLANTIC EXPEDITION 1965 OF THE RESEARCH SHIP METEOR [DIE ATLANTISCHE EXPEDITION 1965 MIT DEM FORSCHUNGSSCHIFF METEOR]

H. Hoeber *In* Deut. Forschungsgemeinschaft Intern. Quiet Sun Yr. (IQSY) 1964/65 1969 7 p In GERMAN (See N70-29026 14-13)

Avail: CFSTI

The Atlantic Ocean expedition of the German research ship Meteor in 1965, carried out measurements on the nucleon and muon components of high energy radiation; magnetic field total intensity; gravity; pressure, wind and temperature; trade-wind circulation system; air-radioactivity, tritium content of air and water, CO2 content and dry fall-out; atmospheric electric field strength. ESRO

N70-29074 World Meteorological Organization, Geneva (Switzerland).

METEOROLOGICAL OBSERVATIONS IN ANIMAL EXPERIMENTS

C. V. Smith, ed. 1970 47 p refs

(WMO-253-TP-140; WMO-TN-107) Copyright. Avail: WMO, Geneva: Sw. Fr. 6

Since livestock production is related to the amount of metabolic heat generated by the animals, which in turn depends upon the rate at which heat is lost by the animals to their environment, the meteorologist can offer valuable services in the endeavour to improve livestock yields, particularly in the tropics, where the need is usually the greatest. This report describes the consequences of different weather conditions on the well-being of animals, and suggests meteorological and related parameters that should be monitored in order to determine as closely as possible the state of the animals' natural or artificial environment. Author (ESRO)

N70-29094# Meteorologisches Observatorium Hohenpeissenberg (West Germany).

RESULTS OF THE SPECIAL PLUVIOGRAPH NETWORK IN 1968 [ERGEBNISSE DES REGENSCHREIBER-SOUNDERNETZES IM JAHRE 1968]

May 1969 60 p In GERMAN *Its* Sonderbeobachtungen des Meteorol. Obs. Hohenpeissenberg No. 2

Avail: CFSTI

In the framework of a special project of the Deutsche Forschungsgemeinschaft (German Research Community) a network of 48 pluviographs (Hellmann-Fuess type; 24-hour drum revolution) was set up in an area of 1000 sq km north of Hohenpeissenberg. The results of registrations during 1968 are given in tables. ESRO

N70-29120# Washington Univ., Seattle. Dept. of Atmospheric Sciences.

RADIATION REGIME OF ARCTIC DRIFTING STATION ARLIS 2, JANUARY 1964 - MAY 1965

Ronald R. Roulet Dec. 1969 68 p refs

(Contract N00014-67-A-0103-0007)

(AD-701342; SR-4) Avail: CFSTI CSCL 4/2

Meteorological observations, with emphasis on the radiation fluxes, were taken on Arctic Ice Island ARLIS-II from January 1964 until May 1965. For 1964 the average net total, net shortwave, and net long-wave radiation CSIRO net total radiometer and the Kipp and Zonen short-wave radiometer were found to be suitable for this work. Author (TAB)

N70-29122# Danish Meteorological Inst., Charlottenlund.

PRELIMINARY REVIEW OF GREENLAND'S CLIMATE FOR PERIODS 1921 - 1950, 1951 - 1960, 1961 - 1965 [FORELOBIG OVERSIGT OVER GRONLANDS KLIMA. 1 PERIODERNE 1921 - 1950, 1951 - 1960, OG 1961 - 1965]

Leo Lysgaard 1969 38 p

(Rept-21) Avail: CFSTI

Meteorological data is presented for different areas of Greenland. The data include barometric pressure; frequency and intensity of wind during severe storms; minimum, mean, and maximum temperatures; average frost and ice cover; minimum, normal, and maximum precipitation; and aerological ratios. Transl. by R.B.

N70-29123# Danish Meteorological Inst., (Charlottenlund).

METEOROLOGICAL YEARBOOK. PART 2: GREENLAND, 1967 [METEOROLOGISK ARBOG. 2DEN DEL: GRONLAND, 1967]

Copenhagen Centraltrykkeriet 1969 47 p In DANISH and FRENCH

Avail: CFSTI

Daily meteorological data is presented for weather stations in Greenland during 1967. Daily measurements are given for air temperature and atmospheric pressure, vapor pressure, relative humidity, wind direction and intensity, amount of precipitation, snow cover, and cloud cover. Monthly and annual summaries are given for mean atmospheric pressure and temperature, mean wind velocity and intesnity, mean humidity, cloud cover, and precipitation. Transl. by R.B.

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N70-28237*# Sperry Rand Research Center, Sudbury, Mass.
STRAPDOWN NAVIGATION COMPUTER STUDIES Final Report
Mar. 1970 148 p refs
(Contract NAS9-9705)
(NASA-CR-108429; SRRC-CR-70-8) Avail: CFSTI CSCL 17G

The work which is reported here divides into four major activities. The first part of the activity is a study of means whereby a strapdown computer such as the one constructed for laboratory use under a previous contract may best be organized and implemented in reliable, flight-ready form. The second activity is an investigation of optimum means for performing attitude reference computations when redundant dodecahedron sensor arrays are utilized. The third part of the study is a study of an attitude control system employing redundant control moment gyros as actuators. The final part of the study contains the results of further computer simulations of the truncation-error-free direction-cosine computation used in SIMU; methods and results are described. Author

N70-28251*# Massachusetts Inst. of Tech., Cambridge. Charles Stark Draper Lab.
APOLLO GUIDANCE, NAVIGATION AND CONTROL: DESIGN SURVEY OF THE APOLLO INERTIAL SUBSYSTEM
William A. Stameris and Paul F. Jopling, eds. Mar. 1970 189 p ref
(Contracts NAS12-642; NAS9-4065; DSR Proj. 55-31650; DSR Proj. 55-23870)
(NASA-CR-86374; E-2500) Avail: CFSTI CSCL 17G

The history of the Apollo Inertial Subsystem design and development (CSM and LM) is reported to provide a source document for subsequent design criteria monographs. The design, development, and testing of an inertial subsystem intended for manned spaceflight beyond earth orbits are included. In addition, the experience and knowledge accumulated by this portion of the Apollo program are highlighted. Finally, technical and program-oriented recommendations have evolved naturally from the experience documented and such recommendations are given as an important part of this Design Survey. Author

N70-28294# Naval Research Labs., Washington, D.C.
COMMUNICATIONS SCIENCES: PROBLEM NOTES
In its Rept. of NRL Progr. Mar. 1970 p 26-27 (See N70-28291 14-34)
Avail: CFSTI

The Mark III Omega Aircraft Navigation Set, consists of crossed-loop antenna system, a receiver, a timing system, and a navigation computer which generates continuous outputs including latitude-longitude, bearing and distance to a destination, and cross track error. Evaluation flights of the Mark III were made over the continental United States, the North Atlantic, the Pacific, and the Carribean. Omega was used as the primary navigation mode on overwater portions of the flights with a course deviation indicator providing continuous steering information to the pilots. In the 10.2 kHz carrier mode, the system provided rms in-flight accuracies of approximately 1 mile during daylight and better than 2 miles during night and transition periods. In the 1133-1/3 Hz, wide lane, carrier difference mode the system provided rms in-flight accuracies of better than 10 miles without utilizing corrections for shift in propagation. Author

N70-28338*# Pennsylvania Univ., Philadelphia. Moore School of Electrical Engineering.
AN ANALYSIS OF THE USE OF OPTICAL TECHNIQUES IN SYNCHRONOUS NAVIGATION SATELLITES Interim Technical Report
Robert E. Lefferts May 1970 177 p refs
(Grant NGL-39-010-087)
(NASA-CR-110080; Rept-70-10) Avail: CFSTI CSCL 17G

The feasibility of using optical and infrared technology for use in synchronous navigation satellites is examined. The analysis is based primarily on a determination of the quality of the image available to the detector under various conditions and not on the properties of the detector itself except for the resolving power of the detector. Initially a passive-user system is considered where the navigation satellite detects the infrared energy emitted by the user's engines. Jet aircraft were considered first because of the relatively large amount of infrared energy emitted by their engines. By considering the energy incident on a single resolvable image element it was found that the signal energy available could not be reliably distinguished from changes in the effective background temperature of the earth. It was concluded that a navigation system using passive infrared detection from synchronous altitude is not feasible. It is concluded that optical techniques do not represent a feasible alternative to the use of radio frequency techniques for synchronous navigation satellites. Author

N70-28344*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EXPERIMENTAL INVESTIGATION OF AN ATTITUDE CONTROL SYSTEM THAT USES STAR TRACKERS AND INERTIA WHEELS
Robert D. Showman and Bruce H. Dishman Washington June 1970 41 p ref
(NASA-TN-D-5843; A-3515) Avail: CFSTI CSCL 17G

Three methods of processing star tracker gimbal angle measurements to derive attitude control signals for a satellite were simulated with spacecraft-type hardware. Each method is a simplification of the exact kinematic equations relating the star tracker gimbal angle rates to the satellite angular rates. An analytic analysis has shown a system that uses any one of the three methods is a table for for small deviations about the commanded attitude. The attitude control system consisted of an air-bearing table to simulate the satellite, gimbaled star trackers for attitude information, motor-inertia-wheel combinations to change the satellite's attitude, and simulated stars as targets for the star trackers. An on-line digital computer performs as a real time controller by converting the star tracker gimbal angle measurements into attitude control signals. Author

N70-28538*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
NASA SPACE VEHICLE DESIGN CRITERIA, GUIDANCE AND CONTROL: ENTRY VEHICLE CONTROL
Washington Nov. 1969 51 p refs
(NASA-SP-8028) Avail: CFSTI CSCL 17G

The data presented pertains to all types of entry vehicles that use aerodynamic forces for deceleration. The entry phase of flight is assumed to begin with the orientation of the vehicle for entry into the atmosphere and to end at 100,000 ft altitude or deployment of the terminal landing device. The state-of-the-art of entry control is reviewed, based primarily on the design, development, and flight experience with the Mercury, Gemini, Apollo, X-15, ASSET, and PRIME vehicles, and from preliminary design studies of advanced logistics vehicles. The entry-control systems of these vehicles are briefly described and appraised. Criteria are discussed in terms of performance, crew safety and flightworthiness, and the effective use of sensors, computers, displays, and other onboard equipment. M.G.J.

N70-28696*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
A CASE STUDY OF THE APOLLO LUNAR MODULE DIGITAL AUTOPILOT

Kenneth J. Cox Apr. 1970 29 p refs Presented at IEEE 1969 Case Studies in System Control Conf., Boulder, Colo., 4 Aug. 1969
(NASA-TM-X-58044) Avail: CFSTI CSCL 17G

The lunar module autopilot is a first-generation digital control-system design. The two torque sources available for the control function of the descent-state configuration consists of 16 reaction jets and a slow, gimbaled, throttlable engine. This case study includes a review of the design history, the design requirements, criteria, constraints, and general design philosophy of the control-system development. Comparative flight-test results derived from design testing are presented. Author

N70-28712# Department of Transportation, Washington, D.C.
REPORT OF DEPARTMENT OF TRANSPORTATION AIR TRAFFIC CONTROL ADVISORY COMMITTEE. VOLUME 1
Dec. 1969 114 p refs
Avail: SOD $1.25

Recommendations of the Department of Transportation Air Traffic Control Advisory Committee to improve air traffic control systems and procedures are presented. Development programs are recommended which will lead to the following functional capabilities: (1) a doubling of major urban airport capacity with reduction in perceived noise below current levels, (2) an ability to maintain, if not improve, freedom of flight with greater safety, and (3) substantial increases in the availability of controllers to handle traffic through additional system automation. Author

N70-28713# Department of Transportation, Washington, D.C.
REPORT OF DEPARTMENT OF TRANSPORTATION AIR TRAFFIC CONTROL ADVISORY COMMITTEE. VOLUME 2: APPENDIXES
Dec. 1969 488 p refs
Avail: SOD $4.25

A risk model for airport landing operations is presented. Emphasis is placed on simultaneous use of closely spaced parallel runways and on reduction of longitudinal separation on final approach. Based on certain simplifying assumptions, the missed approach and collision rates are evaluated. A description is given of the type of studies required in order to validate the conclusions suggested by the model. Author

N70-28773# National Aviation Facilities Experimental Center, Atlantic City, N.J.
TECHNICAL EVALUATION OF INTERROGATOR SET AN/TPX-42 TYPE 3 AND TYPE 4 SYSTEMS (DIRECT ALTITUDE AND IDENTIFY READOUT) Final Report, Sep. 1968 - Jul. 1969
Anthony D. Bradley May 1970 151 p refs
(FAA-RD-70-14; FAA-NA-70-13) Avail: Issuing Activity

The AN/TPX-42 Direct Altitude and Identify Readout (DAIR) equipments were evaluated to determine their capability of extracting and decoding beacon identity and altitude replies and displaying them, in an acceptable form, on a plan position indicator presentation. The technical tests included preparatory measurements of the radar site parameters and fruit environment. Both the Type III and Type IV systems were subjected to tests involving pulse, reply, target, and code processing. Range and azimuth resolution and accuracy tests were performed in addition to an examination of the display processor functions. The maintainability aspects of both systems were investigated during the entire evaluation period. Flight tests were conducted on both systems to the entire evaluation period. Flight tests were conducted on both systems to investigate the ability of the DAIR equipment to perform its functions in a controlled, live environment. Results demonstrate that the functions of decoding, processing, and displaying beacon identity and altitude replies. The systems are technically acceptable for use in air traffic control terminal environment, and are compatible with their associated radar and beacon systems. The systems are maintainable and, with additional troubleshooting aids, the time required to restore the equipment to operation after a failure can be reduced. Author

N70-28826*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
SOLAR POINTING AEROBEE ROCKET CONTROL SYSTEM (SPARCS) Final Report
Nov. 1969 233 p refs
(Contract NAS2-3500)
(NASA-CR-73439; LMSC-A972158) Avail: CFSTI CSCL 17G

Several aspects of the control system design and function of Solar Pointing Aerobee Rocket Control System (SPARCS) were specified in the RFP. The Aerobee rocket, which consists of a boost engine, sustainer engine, payload section, and nose cone, is spin-stabilized during the powered flight portion of the ascent trajectory. After sustainer engine burnout, the attitude control functions would be acquired by SPARCS, which was to be housed in a control insert in the payload section. The SPARCS control task was to point the longitudinal axis of the rocken toward the sun and to provide roll stabilization about that axis during the 4 to 5 minutes of ballistic flight above the earth's atmosphere. The SPARCS control function was to be divided into four phases: despin, coarse acquisition of the sun, fine acquisition, and fine pointing. The attitude reference for the last two phases was to come from a specially designed Fine Sun Sensor. Author

N70-29065# Deutsche Gesellschaft fuer Ortung und Navigation E. V., Duesseldorf (West Germany).
ATTITUDE REFERENCE PLATFORM FOR ROTATING ALTITUDE RESEARCH ROCKETS
M. Puetz 1969 22 p Presented at the Intern. Navigation Meeting, Hamburg, 28-30 Oct. 1969
Avail: CFSTI

A gyrostabilized platform which provides the reference attitude for the Dornier Astrid attitude control system used for rocket stellar spectroscopy is described. The specification and design of the platform for use in 1970 are discussed. ESRO

N70-29092# Laboratoire de Physique Theorique et Aerodynamiques, Vernon (France).
PRELIMINARY FEASIBILITY STUDY OF GUIDANCE FOR THE EUROPA 3B [ETUDE PRELIMINAIRE DE FAISABILITE DU PILOTAGE]
A. De Berranger and M. Boudet 16 Sep. 1969 122 p In FRENCH Sponsored by ELDO
(LRBA-NT-72/69/SEN/AS) Avail: CFSTI

Two solutions are presented for the control of the Europa 3B engine. The first solution is concerned with the energetic filtering of the signal command of the ejectors, correlatively given, and with the aid of the sernomotors, a dephasing of near 180 degrees at the right of the proper pulsation from the first mode. In these conditions, this mode is stable when the gyrostabilizer is placed before the antinode of first proper form. This solution notably weakens the superior modes which facilitates their gain control. In the second solution, the filtering of the signal command of the ejectors is weak. The first mode is stable when the mode is placed after the antinode. This solution has the advantage of lessening the rigid mode of the stability margin. Calculated data for both solutions are summarized in tabular and graphical forms. Transl. by J.M.C.

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N70-27857# Argonne National Lab., Ill.
A STUDY OF THE DYNAMIC RESPONSE OF VARIOUS EBR-2 CONFIGURATIONS TO HYPOTHETICAL MALFUNCTIONS IN THE REACTOR SYSTEM

A. V. Campise Nov. 1969 87 p refs
(Contract W-31-109-eng-38)
(ANL-7613) Avail: CFSTI

The dynamic response characteristics of various EBR-2 irradiation-configuration loadings were investigated by using the space-independent kinetics code AIROS-2A for dynamic simulation of the reactor system. The basic dynamic model was first used on system malfunctions outlined in the EBR-2 hazards summary report and shown to give very good agreement with published data. Subsequent irradiation core loadings were studied under various assumed hypothetical accident conditions to establish the details of the dynamic response of various metallic- and ceramic-fueled subassemblies. Dynamic response differences are noted under conditions of reduced and full coolant flow. Ceramic-fueled subassemblies will tend first to release activity under all transient conditions with full coolant flow. Conversely, metallic-fueled subassemblies will tend first to release activity under loss-of-flow conditions for all the cases studied. Author (NSA)

N70-27858# Eidgenoessiches Institut fuer Reaktorforschung, Wurenlingen (Switzerland).
HETEROGENEOUS REACTOR LATTICE PROGRAMMES USING THE OPEN CELL TECHNIQUE
Ronald Alpiar Aug. 1969 71 p refs
(EIR-160) Avail: AEC Depository Libraries

An implementation of the Heterogeneous Lattice Theory of T. Auerbach is described. The theory is a two-dimensional multigroup approach, with a lattice consisting of various types of finite-radius elements, all immersed in a single, finite, reflected moderator. Solutions are obtained in 2-dimensional cylindrical geometry, enabling the moderator flux and system eigenvalue to be computed. The characteristics of the lattice elements are determined by an auxiliary P sub 3 cylindrical computation. Fortran computer programs for performing the calculations are described, together with instructions for the preparation of data. Author (NSA)

N70-27860# Babcock and Wilcox Co., Lynchburg, Va. Power Generation Div.
FAST BREEDER REACTOR STATIC PHYSICS METHODS DEVELOPMENT AND ANALYSIS PROJECT. VOLUME 4: PRODUCTION TESTS AND SENSITIVITY STUDIES USING THE FARED CODE
R. J. Neuhold Nov. 1969 36 p refs
(Contract AT(30-1)-3867)
(BAW-3867-9-Vol-4) Avail: CFSTI

The FARED computer program and associated library have been used to calculate ZPR-3 Assembly 48 and ZPR-3 Assembly 11. The calcuated results for k sub eff, spectral indices, central reactivity worths, Doppler coefficients and fluxes are compared with reported experimental data. Additional calculated data on the two assemblies are provided as B and W's contribution to the CSEWG Phase II, ENDF/B data evaluation. Sensitivity studies using the B and W-1000 MW(e) Follow-On reference design are presented. These studies include: the effect of cross section re-averaging during depletion; the effect of homogeneous versus heterogeneous resonance treatment; the effect of the number of groups and downscatter groups on criticality and depletion; and the effect of buckling values in spectrum generation. Author (NSA)

N70-27888# Central Electricity Generating Board, Berkeley (England). Research and Development Dept.
THE BEHAVIOUR OF RADIOACTIVE ISOTOPES IN LIQUID METAL COOLED FAST REACTORS. PART 1: A SURVEY OF THE CHEMICAL PROBLEMS
H. E. Evans and W. R. Watson Dec. 1969 17 p refs
(RD/B/N-1512) Avail: AEC Depository Libraries

The chemical problems which are relevant to the behavior of radioactive materials in liquid metal cooled fast reactor systems are considered. The behavior of the fission product is considered from its formation in the fuel element. The ultimate fate of the active material which may include plate out or adsorption on constructional material, reaction with hot surfaces, escape to the gas blanket, release to the atmosphere is seen to be strongly dependent on its chemical binding both in the fuel and in the liquid metal. There is not yet sufficient knowledge of the chemical binding of fission products in the fuel element, dissolved in liquid metals, released in coolant fires or of the mechanism of adsorption and deposition processes in liquid metal systems. Author (NSA)

N70-27892# Eidgenoessiches Institut fuer Reaktorforschung, Wurenlingen (Switzerland).
CARBIDE-FUELLED FAST BREEDER REACTOR WITH MOLTEN CHLORIDE AS FUEL BONDING MATERIAL AND CHLORIDE VAPOUR AS COOLANT
M. Taube and H. Schumacher Oct. 1969 35 p refs
(EIR-167) Avail: AEC Depository Libraries

Two methods are proposed for improving the performance of a fast reactor. These are: the use of fused chlorides as bonding and heat transporting material in a three phase fuel element with PuC - UC or nitride solid fuel material; and the use of aluminum trichloride vapor as coolant for the reactor core and as working fluid in the turbine (800 C, 90 ata). When used in a dual circuit system (e.g., with nitrogen dioxide in the lower temperature cycle) this increases the net power station efficiency to 60%. This also substantially decreases the size of the turbine and improves the technical and economic characteristics of the power station. Author (NSA)

N70-27900# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.
REACTOR PRIMARY COOLANT SYSTEM RUPTURE STUDY Quarterly Progress Report, Apr. - Jun. 1969
Jul. 1969 30 p refs
(Contract AT(04-3)-189)
(GEAP-10072; QPR-17) Avail: CFSTI

A low cycle fatigue crack growth rate equation and the independence of successive transformed raw data points were examined. It was concluded that the model was not entirely perfect due to various rates of crack growth. The PAPA/EPS computer code for stress analysis is evaluated; and finite element computer codes are briefly mentioned. The experimental results of crack growth in part-through surface cracked plates of 2-1/4 Cr-1 Mo at room temperature are compared with those obtained on through-cracked specimens for identical conditions of tension-compression, strain-controlled loading. The observed effect of flaw geometry was reconciled and estimated from flaw shape effects predicted by fracture mechanics considerations. The results of a fatigue machine during initial, hot shakedown tests are given. The fatigue specimen with an axial hole was selected for the program, based on the test results of 19 axial hole specimens and 9 transverse hole specimens. J.A.M.

N70-27908# Gulf General Atomic, San Diego, Calif.
GAS-COOLED FAST BREEDER REACTOR Quarterly Progress Report, 1 Aug. - 31 Oct. 1969
30 Nov. 1969 48 p refs
(Contract AT(04-3)-167)
(GA-9811) Avail: CFSTI

A draft of the reactor system development plan was prepared. Fuel rod concepts and alternative core design concepts are analyzed, including an evaluation and an analytical model of the fuel rods. Creep strains of cladding and fuel rods are calculated using the viscoelastic approach. The effect of fuel cladding compatibility on fuel rod behavior is assessed, and high and medium burnup thermal flux tests and fast flux tests are evaluated. The one to one, hydrogen to plutonium ratio critical assembly experiment was completed. Three critical experiments were reevaluated using the current Pu-239 cross section data. J.A.M.

N70-27909# General Electric Co., Sunnyvale, Calif. Breeder Reactor Development Operation.
SOUTHWEST EXPERIMENTAL FAST OXIDE REACTOR DEVELOPMENT PROGRAM Quarterly Report, Aug. - Oct. 1969

G. R. Pflasterer and R. A. Becker, comps. Nov. 1969 50 p refs
(Contract AT(04-3)-540)
(GEAP-10010-22; QR-22) Avail: CFSTI

Specifications for the reactor and experimental program, steady state and transient characteristics of the core assembly, and reactivity required for experimentation were determined. Final preoperational test and analysis work was carried out on the fuel thermocouples, along with startup testing of reactor cores. The design of the fuel transfer equipment and the shielding associated with fuel transfer was completed. To enhance the safe operation of the facility, a program for auditing operations was initiated. Type 2 reactor vessel level probes were also completed. J.A.M.

N70-27922# Technische Hogeschool, Delft (Netherlands).
LIQUID METAL FAST BREEDER REACTOR DEVELOPMENT IN THE UNITED STATES OF AMERICA (WITH AN EMPHASIS ON THE INDUSTRIAL APPROACH)
H. R. Kleijn 31 Jul. 1969 102 p refs
(IRI-131-69-1) Avail: AEC Depository Libraries

Activities of U.S. fast reactor designers in regard to problems encountered in the development of liquid metal fast breeder reactors are described. After an introduction dealing with a general status outlook on fast reactors, aspects of system design, physics and component development are discussed. Further, comments are given in regard to the feasibility of fast reactors as well as to the expected safety performance. Finally, it is concluded that: (1) Commercially competitive fast reactors will probably require an additional 15 years of development work specifically in the areas of materials (including fuel) and instrumentation. (2) Successful development and subsequent design and construction of a fast reactor can be performed only by a group that has an optimum number of highly qualified personnel, where the optimum depends on the scope of work. The success of the project, however, depends as much on proper management as on technical skills. Author (NSA)

N70-27923# Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.
FFTF CONTROL ROD DRIVE MECHANISM CONTINUATION STUDY (TASK 13)
D. L. Dill, J. M. Kazan, and P. J. Lain May 1969 127 p refs
(Contract AT(30-1)-3977)
(WARD-3977-2) Avail: CFSTI

A conceptual design is presented for a 4-coil magnetic jack Control Rod Drive Mechanism (CRDM) suitable for locating in the head of the FFTF annular conical core reactor concept. The design presented should be applicable to other reactor concepts with similar requirements. The design presented will: (1) provide increments of 0.150 inch of control rod step motion; (2) provide a maximum speed of rod motion of 0.15 in./sec (9 in./min); (3) provide for 44 inches of rod travel; (4) carry a drive line assembly weight of up to 500 pounds; and (5) provide for a rod insertion time of less than 0.39 second from when the signal reaches a fully withdrawn mechanism till the control rod is completely inserted into the core. This design presents a minimum effective length mechanism, with respect to present state-of-the-art knowledge. The operational environment of this mechanism was sufficiently analyzed in this concept to establish feasibility. Author (NSA)

N70-27945*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
REACTOR RADIATION SHIELDING
Martin O. Burrell and Henry E. Stern *In its* Radiation Phys. Res. at MSFC: Res. Achievements Rev., v. 3 1969 p 19-24 refs
(See N70-27942 14-24)
Avail: CFSTI CSCL 18F

The primary effort in reactor radiation shielding research was directed toward application to the nuclear rocket program. Tasks involved the comparison and evaluation of various shield calculation methods including; point kernel, discrete ordinates or angular segmentation, and stochastic or Monte Carlo. The goal of this effort was to select, formulate, and program a final design method. A summary of the work performed including a synopsis of the methods, the results of analyses and comparisons, and descriptions of all the programs considered is presented. Auth

N70-28043# Central Electricity Generating Board, Berkeley (England). Berkeley Nuclear Labs.
IRRADIATION CREEP OF URANIUM DIOXIDE
E. C. Sykes and P. T. Sawbridge Nov. 1969 14 p refs
(RD/B/N-1489) Avail: AEC Depository Libraries

The irradiation induced creep of UO2 was measured in-pile by observing the deflections of helical springs placed in compression. Preliminary analysis of the results of the first two tests indicates the irradiation creep rate per hour is approximately 10 to the minus tenth power R sigma where R = rating MW/te(u); sigma = stress psi. Author (NSA)

N70-28059*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TECHNOLOGICAL PROBLEMS ANTICIPATED IN THE APPLICATION OF FUSION REACTORS TO SPACE PROPULSION AND POWER GENERATION
J. Reece Roth, Warren D. Rayle, and John J. Reinmann [1970] 17 p refs To be presented at the 5th Intersoc. Energy Conversion Eng. Conf., Las Vegas, Nev., 20-25 Sep. 1970 Sponsored by the AIAA
(NASA-TM-X-52809) Avail: CFSTI CSCL 18N

Mission and system studies have shown that fusion reactors potentially may be the most attractive energy source for space power and propulsion systems. The methods by which fusion reactors may be applied to space missions are discussed. The problems posed by conversion of the thermal energy of the reacting plasma to electrical power and/or an exhaust jet are considered. Conceptual approaches to space applications are described, and their implications for research and development in the 1970's are reviewed. Recent analytical and experimental studies are reviewed, and their significance for the future direction of space-related fusion research is discussed. Author

N70-28152# Eidgenoessiches Institut fuer Reaktorforschung, Wuerenlingen (Switzerland).
MEASUREMENT OF THE RELATIVE CONVERSION RATIO IN A D20 MODERATED LATTICE FUELLED BY NATURAL URANIUM
R. Richmond, B. Rueeger, and A. Windiate Oct. 1969 40 p refs
(EIR-165) Avail: AEC Depository Libraries

Measurements have been made, in the reactor PROTEUS, of the relative conversion ratio in a D2O-moderated lattice fueled by a gas-cooled cluster of natural uranium metal rods. The lattice was similar to that of the LUCENS experimental power station. The results were compared with the predictions of the U.K. lattice code WIMSD and the discrepancy was found to be consistent with that normally given by this code for D2O-moderated lattices. Author (NSA)

N70-28162# Atomic Energy Establishment, Winfrith (England).
RESONANCE CAPTURE IN PU 240. PART 3: PLUTONIUM CARBIDE PARTICLES IN A GRAPHITE MATRIX
J. R. Askew and G. M. Carpenter Aug. 1969 17 p refs
(AEEW-M-236) Avail: AEC Depository Libraries

The effective energy-dependent cross sections of Pu-240 in PuC particles are determined using a simple collision probability argument, an approximation applicable to a range of concentrations of such particles in a graphite matrix. The resonance escape probability at temperatures of 300 and 1500 K is then calculated for a mixture of infinite extent and the temperature coefficient deduced. Resonance capture in such systems is shown to be considerably reduced by the use of a fuel in particle form. Author (NSA)

N70-28242 Kansas Univ., Lawrence.
A STUDY OF COBALT-60 GAMMA RADIATION

TRANSPORT BY MEANS OF THE MONTE CARLO METHOD
Raymond Russell Nydegger (Ph.D. Thesis) 1969 212 p
Avail: Univ. Microfilms: HC $9.70/Microfilm $3.00 Order No. 69-21560

A Monte Carlo computer program was written to calculate the amount of gamma radiation which would be transported in a wall or floor of one material such as concrete and around or beneath a wall of another material such as lead. No limitation was placed on the composition of either wall or floor. The method of calculation was that of forced-collision with analytical averaging to account for photon absorption and photon escape from the media. Photon escape beyond the high density, high Z wall was scored as a function of photon energy and location of escape. Photon density and fluence, energy density and fluence, and exposure were scored as a function of photon energy (energy spectra) for twenty-four regions of escape on the outer surface of the low density, low Z material. Verification of the validity of the computer program and the Monte Carlo method was accomplished by experimentally measuring the exposure transported beneath a lead wall which was recessed into a concrete floor. Measurements were performed using a cobalt-60 source for three geometrical configurations of wall and floor. Data for 1.25 Mev incident photons were generated using the computer program for twenty-four different combinations of beam incidence lead wall thickness, and depth of recession of the lead wall into a concrete floor. Dissert. Abstr.

N70-28268# Argonne National Lab., Ill.
REACTOR DEVELOPMENT PROGRAM Progress Report, Nov. 1969
31 Dec. 1969 141 p ref
(Contract W-31-109-eng-38)
(ANL-7640) Avail: CFSTI

Highlights of project activities are summarized for the month of November 1969. LMFBR physics and component development and Na coolant technology are reviewed. Operations and analysis of the ZPR-3, ZPR-6, ZPR-9, and ZPPR are described. The status of EBR-II research and development and irradiation testing projects is summarized. Reactor fuels, materials development, and nuclear safety studies, including TREAT operations, are described. Author (NSA)

N70-28277# Gulf General Atomic, San Diego, Calif.
APPLICATION OF PHOTOINDUCED REACTIONS TO NUCLEAR MATERIALS SAFEGUARDS PROBLEMS Project Summary Report, 1 Jul. -30 Jun. 1969
R. L. Bramblett, R. O. Ginavin, T. Gozani, L. Kull, J. I. McMillan et al 29 Jul. 1969 91 p refs
(Contract AT(04-3)-167)
(GA-9614) Avail: CFSTI

Progress in the development of assay techniques and hardware for quantitative isotopic measurement of special nuclear materials encountered in the nuclear fuel cycle are reported. Some results on prompt and delayed neutron yields and fission-product gamma rays are presented. Some new techniques for the analysis of assay data are described and some results on assays of uranium oxide and uranyl nitrate samples are given. The improvements made in experimental facilities at the electron LINAC are described. NSA

N70-28318# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorbauelemente.
HYDRAULIC OR PNEUMATIC DEVICE FOR READING THE POSITION OF A CONTROL ROD IN A NUCLEAR REACTOR
O. Muehlhaeuser Apr. 1969 34 p In GERMAN
(KFK-951) Avail: AEC Depository Libraries

The construction principles and test results of a hydraulic or pneumatic device for reading the position of a control rod in a reactor, which is completely separated from and independent of the positioning mechanism, are described. The device can be operated either hydraulically or pneumatically and can be used in water, steam, or gas and the temperature of the medium is of secondary concern. The reading device is based on the principle in a four-section hydraulic bridge circuit in which two sections are different so that the change of these two sections is a function of the positioning motion of the control rod. The necessary pressure drop for the operation of the bridge was provided by pressure decrease of the tapped reactor pressure and was maintained by a controller at constant height. NSA

N70-28372# Centre d'Etude de l'Energie Nucleaire, Mol (Belgium).
REPROCESSING OF IRRADIATED FUELS Final Report
8 Apr. 1969 116 p
(Contracts EURATOM-006-65-7-RCIB; EURATOM-016-65-1-RAPB) (EURAEC-2088; EUR-4009) Avail: CFSTI

The reaction mechanism of ClF3 and ClF with UO2 - PuO2 mixtures was investigated as a function of temperature and gas and fuel composition. The decreasing sphere model can be applied to the ClF2 reaction, which also takes place at high speed even with (U - Pu)O2 solid solutions. The monofluoride (ClF) on the contrary can be considered as a selective fluorinating agent for UF6, but its lower reactivity requires much higher reaction temperatures (450 C). Cold technology problems on chemical decladding of stainless steel canned UO2 fuel using HF + O are briefly mentioned. Results from the volatilization of UF6 in fluidized packed-bed reactors are listed. The reaction rates and efficiencies in large columns of various fluorinating gases (ClF2, ClF, F2, HF + O) are discussed and compared. UF6 volatilization rates with ClF3 on UO2 - PuO2 pellets, are discussed along with simultaneous removal of Pu either by volatilization of PuF6 with F2 or by elutriation of Pu containing fines. Author (NSA)

N70-28373# International Atomic Energy Agency, Vienna (Austria).
PLANNING FOR THE HANDLING OF RADIATION ACCIDENTS: A MANUAL PREPARED BY A PANEL OF EXPERTS ON BEHALF OF ILO, FAO, WHO AND THE IAEA
1969 100 p refs *Its* Safety Series No. 32
(STI/PUB-227) Avail: AEC Depository Libraries

This manual is intended as a practical guide for the use of public authorities and others who are responsible for preparing emergency plans for the handling of radiation accidents, with the aim of minimizing the exposure of personnel and the public, and of reducing damage to property. Topics discussed include radiation accidents and their control; organization for handling radiation accidents; the responsibility of public authorities and personnel for the control of radiation sources; guides for decisions on protective action; and essential components of radiation protection plans. A number of specimen emergency plans are appended. NSA

N70-28430# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
METALLOGRAPHIC OBSERVATIONS OF SWELLING IN U3Si
C. R. Hann, R. D. Leggett, and B. Mastel Dec. 1969 25 p refs
(Contract AT(45-1)-1830)
(BNWL-1195) Avail: CFSTI

Experimental hollow core U3Si fuel rods were examined metallographically to determine the type of swelling and the nature of any structural changes in U3Si irradiated at 370 to 570 C. The initial axial void behaved as designed and filled early in the irradiation to accommodate fuel swelling. Microtearing was identified for the first time as being the primary cause of swelling in U3Si at these temperatures. Ion bombardment etching proved to be a very effective technique for the examination of irradiated U3Si. Author (NSA)

N70-28439# Power Reactor and Nuclear Fuel Development Corp., Tokai (Japan).
[DEVELOPMENT OF MIXED URANIUM AND PLUTONIUM OXIDE FUELS FOR FAST BREEDER REACTORS AND ADVANCED THERMAL REACTORS, AND THE DEVELOPMENT OF SPENT FUEL REPROCESSING TECHNOLOGY] Annual Report, 1 Apr. 1968-31 Mar. 1969
Nov. 1969 89 p refs

(PNCT-AR-68) Avail: AEC Depository Libraries

The development of nuclear fuels, including mixed uranium and plutonium oxide fuels, for fast breeder reactors and advanced thermal reactors and the development of spent fuel reprocessing technology and related research work are reported. Research on the preparation and properties of UC and UO2 and materials for cladding for these fuels is discussed. Studies in plutonium fuel design, preparation, and testing are described. Methods for inspecting reactor fuel assemblies and health and safety studies on plutonium contamination are included. NSA

N70-28465# Battelle Memorial Inst., Columbus, Ohio.
AN EVALUATION OF THE APPLICABILITY OF EXISTING DATA TO THE ANALYTICAL DESCRIPTION OF A NUCLEAR-REACTOR ACCIDENT Quarterly Progress Report, Apr. - Jun. 1969
David L. Morrison, Wayne A. Carbiener, and Robert L. Ritzman Jul. 1969 46 p refs
(Contract W-7405-eng-92)
(BMI-1867) Avail: CFSTI

The research and development during this period is reported. Included are the following areas: effects of oxygen dissolution in Zircaloy, reactor safety, and coolant loss accidents in boiling water and pressurized water reactors. NSA

N70-28475# Department of Shipping and Transport (Australia).
NOTES FOR THE GUIDANCE OF PERSONS CONCERNED IN THE CARRIAGE OF RADIOACTIVE SUBSTANCES BY SEA
Jun. 1969 45 p
(NP-18041) Avail: AEC Depository Libraries

Information is presented to assist persons concerned with the packing, storage, and transport of radioactive cargoes in ships. Australian legal requirements for these activities are described. The regulations themselves are not included. Descriptions are given of radioactive materials categories, types of packaging, labeling procedures, shipping document requirements, and personnel safety procedures. NSA

N70-28527# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
IRRADIATION OF MIXED URANIUM AND PLUTONIUM CARBIDE AND NITRIDE FUELS IN THE FAST NEUTRON LOOP MFBS
Hubert Mikailoff, Jacques Leclere, Bernard Kryger, Jacqueline Bloch, and Madeleine Conte [1969] 103 p refs Transl. into ENGLISH from the French Report
(EURFNR-688; CEA-N-1186) Avail: CFSTI

A description is given, together with results of two irradiation experiments carried out on mixed-carbide and nitride-type fuels. The experiments were done in the fast neutron loop MFE S designed by the Mol Nuclear Research Centre. In one experiment, four small sodium-bonded fuel elements (mixed-carbide, nitride, carbonitride, and alloyed carbide) were tested. The linear power ranged from 1700 to 2400 W/cm and the burnout from 12,500 to 16,000 MWd/t. In another experiment, the behavior of mixed-carbide and nitride fuels clad with helium and sodium bonds and irradiated under particularly severe thermal conditions, was examined (heat flux: 1000 W/sq cm; maximum linear power: 3300 W/cm; maximum temperature in nitride fuel: 2500 C). Author (NSA)

N70-28544# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
OSIRIS SAFETY STUDY. THERMAL POWER EXTRACTABLE IN NATURAL CONVECTION
Philippe Vernier Jan. 1970 48 p refs In FRENCH
(CEA-N-1140) Avail: AEC Depository Libraries

The residual thermal power extraction by natural convection in Osiris after primary coolant pump failure is analyzed. The cooling of the reactor fuel channel by natural convection is studied in a reactor small scale model. The behavior of channels put in the thermal environment created by the reactor core is described. A 2 mm diameter hot channel and a 1 mm diameter channel placed between the vessel and a cold plate are studied. NSA

N70-28546# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
BEHAVIOR OF FISSION PRODUCTS OBSERVED IN THE COURSE OF OPERATION OF CEN, SACLAY REACTORS
Ph. Lebouleux and H. Petitcolas [1969] 15 p refs In FRENCH Presented at the Intern. Congr. on the Diffusion of Fission Products, Saclay, France
(CEA-CONF-1435; CONF-691104-3) Avail: AEC Depository Libraries

A description of fission product behavior in the EL-3, OSIRIS, and ISIS reactors subsequent to fuel element rupture is given. The fuel rupture incident in the EL-3 is described; the fission product release into the cooling water, and, subsequently into the air is discussed. Fission product activities and curie amounts are tabulated for the time span of 3 months, 6 months, and 1 year following the rupture. Similar discussions, descriptions, and data are included for the ISIS and OSIRIS incidents. NSA

N70-28577# Physikalisch-Technische Bundesanstalt, Brunswick (West Germany).
MEASUREMENT OF THE SPECTRAL DISTRIBUTION OF NEUTRON FLUX IN THE ENERGY RANGE FROM 1.5 TO 8.0 MeV IN THE TANGENTIAL BEAM TUBE S2 OF THE BRAUNSCHWEIG RESEARCH AND TESTING REACTOR (FMRB) [MESSUNG DER SPEKTRALEN VERTEILUNG DER NEUTRONENSTROMDICHTE IM ENERGIEBEREICH VON 1,5 BIS 8,0 MEV AM TANGENTIALEN STRAHLROHR S2 DES FORSCHUNGS- UND MESSREAKTORS BRAUNSCHWEIG (FMRB)]
H. Kluge Jun. 1969 22 p refs In GERMAN; ENGLISH summary
(FMRB-26/69) Avail: AEC Depository Libraries

The neutron spectrum in the energy range from 1.5 to 8.0 MeV was measured by means of a proton recoil telescope in the tangential beam tube S2 of the FMRB. The current density of the thermal neutrons was determined. These data were used for the calculation of the ratio of the differential source strength of the reactor neutrons scattered elastically or inelastically by a converter foil of enriched U-235 to the differential source strength of the fission neutrons. 11 references. Author (NSA)

N70-28585# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorentwicklung.
SIMULATION OF COOLANT EJECTION IN THE NA-2 FUEL ELEMENT
P. Fette and H. D. Grossgarten Jan. 1969 13 p refs In GERMAN
(KFK-925; EUR-4169) Avail: AEC Depository Libraries

Bubble propagation in a rod bundle with fuel element dimensions was followed experimentally using optical methods. The experimental results indicated that, in perturbations in the reactor as a result of bubble formation due to overheating of the sodium, the bubbles formed completely fill the cross section of the fuel elements concerned. A calculation of the ejection processes after BLOW is based on a true definition of the bubble cross section surface. NSA

N70-28595# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Angewandte Reaktorphysik.
CRASH: A COMPUTER PROGRAMME FOR THE ANALYSIS OF CREEP AND PLASTICITY IN FUEL PIN SHEATHS
M. Guyette Aug. 1969 77 p refs
(KFK-1050) Avail: AEC Depository Libraries

A computer program, calculating the thermal and mechanical behavior of fuel pin sheaths, has been written in the framework of the development of the Na cooled fast breeder reactor SNR. This program, named CRASH (CReep Analysis in a fuel pin SHeathl.

calculates the tri-axial stress and strain states when creep or plasticity takes place in the material. The basic assumption for this calculation is the axi-symmetry of the sheath. The loads, which can be taken into account by the program, are: an outer pressure, an inner pressure, a temperature gradient and a fuel-clad radial and axial interaction. These loads can be any functions of time. Author (NSA)

N70-28596# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Neutronenphysik und Reaktortechnik.
FAUN-Z: CALCULATIONS OF SEVERE REACTOR ACCIDENTS ACCORDING TO THE MODIFIED BETHE-TAIT METHOD IN r, Z GEOMETRY [FAUN-Z: BERECHNUNG SCHWERER REAKTORUNFAELLE NACH DER MODIFIZIERTEN BETHE-TAIT-METHODE IN R, Z-GEOMETRIE]
K. Thurnay Apr. 1969 56 p ref In GERMAN Sponsored in part by EURATOM
(KFK-1044; EUR-4310) Avail: AEC Depository Libraries

For the IBM 7074 computer, a program is developed that allows calculation of severe excursions in a cylindrical two-zone reactor core. The program is based on the modified Bethe-Tait method. The underlying mathematics is described in detail. Actual computer programs are listed and results are tabulated. NSA

N70-28603 European Organization for Nuclear Research, Geneva (Switzerland).
THE ISOLDE ISOTOPE SEPARATOR ON-LINE FACILITY AT CERN
A. Kjelberg and G. Rudstam, eds. 19 Jan. 1970 135 p refs
(CERN-70-3) Copyright. Avail: Issuing Activity

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10. ON THE DELAY BETWEEN PRODUCTION AND MEASUREMENT IN SEPARATOR-ON-LINE SYSTEMS FOR THE STUDY OF SHORT-LIVED NUCLIDES G. Rudstam p 123–140 refs (See N70-28613 14-24)

N70-28618# Comitato Nazionale per l'Energia Nucleare, Casaccia (Italy). Lab. Fisica e Calcolo Reattori.
CALCULATING THE TRANSIENT POWER FOR THE ROSPO WATER MODERATED REACTOR [CALCOLO DEI TRANSITORI DI POTENZA PER IL REATTORE ROSPO MODERATO AD ACQUA]
R. Conversano, N. Lombardi, and A. Sacco 26 Feb. 1969 57 p refs In Italian
(RT/FI(69)21) Avail: CFSTI

An analysis is made of the power escursion generated in the water-moderated ROSPO reactor, as a consequence of a nuclear accident caused by an increase in the moderator water level. The effects on the power generation of the safety system are also considered. The analysis was carried out by means of an analogue computer. Author

N70-28620# Oak Ridge National Lab., Tenn.
DESIGN CONSIDERATIONS OF REACTOR CONTAINMENT SPRAY SYSTEMS. PART 3: THE CORROSION OF MATERIALS IN SPRAY SOLUTIONS
J. C. Griess and A. L. Bacarella Dec. 1969 20 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2412-Pt-3) Avail: CFSTI

The use of aqueous solutions containing various chemicals for nuclear reactivity control and iodine absorption has been proposed as a safeguard system in water-cooled nuclear reactors. In the event of a design basis accident such solutions would be sprayed into the containment building to reduce the steam pressure and to scavenge iodine from the atmosphere. For such a system to be practical it must not only accomplish the above two objectives but the corrosive nature of the solution must be such that the containment and emergency equipment must not be jeopardized, thereby propagating the accident. A program was undertaken to determine the corrosion rates of materials normally found in reactors and their containment buildings in spray solutions. Specimens of materials were exposed, both in the spray and totally submerged, over the temperature range of 50 to 140 C. The results of these tests are presented. Author (NSA)

N70-28621# Oak Ridge National Lab., Tenn.
DESIGN CONSIDERATIONS OF REACTOR CONTAINMENT SPRAY SYSTEMS. PART 6: HEATING OF SPRAY DROPS IN AIR-STEAM ATMOSPHERES
L. F. Parsly Jan. 1970 26 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2412-Pt-6) Avail: CFSTI

In a loss-of-coolant accident, cold water sprays are frequently used to reduce the containment pressure. It has generally been assumed that the drops would attain thermal equilibrium with the air-steam mixture in the containment atmosphere. A numerical procedure was developed to calculate the time for a cold water drop to approach the temperature of the atmosphere. Calculations were made for typical drop sizes under hypothetical accident conditions. The results of the calculations confirm the assumption that the drops will essentially come to thermal equilibrium with the atmosphere in full-size reactor containment buildings. Author (NSA)

N70-28628# Kernforschungszentrum, Karlsruhe (West Germany).
EVALUATION OF THE REQUIRED ACCURACY OF CONSTANTS FOR CALCULATION OF FAST POWER REACTORS
S. M. Zaritskii et al [1969] 18 p refs Transl. into GERMAN from the Russian In GERMAN Presented at the Intern. Conf. on the Phys. of Fast Reactor Operation and Design, London, 24-26 Jun. 1969
(KFK-TR-301; Conf-690634-1) Avail: AEC Depository Libraries

Multiplication factor and breeding rate are the two most improtant parameters for evaluating a large fast breeder power reactor. These parameters are calculated from nuclear constants such as neutron capture cross section and fission cross section. The necessary mathematical formulas are developed, especially with accuracy requirements of the constants in question, and, are applied to several Pu-239 - U-238 combinations. One table contains the key parameters for various core arrangements. Two additional

tables show the relationship between multiplication factor and breeding rate to various nuclear constants of Pu-239 and U-238. NSA

N70-28635# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Neutronenphysik Reaktortechnik.
INVESTIGATIONS ON THE ANEX IN GEESTHACT CONCERNING THE USEFULNESS OF REACTIVITY MEASUREMENT FOR FISSIONABLE MATERIAL FLUX CONTROL
M. Kuechle Aug. 1969 22 p refs In GERMAN
(KFK-1040) Avail: AEC Depository Libraries

As a safeguard for the peaceful use of nuclear energy, inspection of the installation and the bookkeeping is performed routinely. A superior control and prevention of deceptions can be accomplished by direct measurement of the U-235 content of the fuel elements. For this purpose, the element is inserted into three different positions within the core of a critical assembly. By recording the neutron flux, U-235 content can be determined within 1% accuracy; deception by altering the cladding material can be detected and exchange of plutonium for U-235 can be readily recognized. The whole procedure requires approximately one minute. The experimental arrangement is described, and the findings are depicted in six diagrams. NSA

N70-28689# Eidgenoessiches Institut fuer Reaktorforschung, Wurenlingen (Switzerland).
GAS COOLED FAST REACTOR USING A DIRECT CYCLE GAS TURBINE
L. A. Lys and E. Utzinger Oct. 1969 15 p refs Presented at the 2d Intern. Fair and Tech. Meetings for Nucl. Industries, Nuclex 69, Basel, Switzerland
(EIR-163; CONF-691018-1) Avail: AEC Depository Libraries

A design of a 1000 MWe gas cooled fast reactor using direct cycle gas turbines for power generation is presented. The fuel is mixed PuO2 - UO2 in the form of metal clad fuel rods. It is shown that due to the inherently low fuel cycle cost characteristic of this reactor type attractive performance figures can be obtained using can materials based on present day technology. Author (NSA)

N70-28721# Oak Ridge National Lab., Tenn.
OAK RIDGE RESEARCH REACTOR Quarterly Report, Jul. - Sep. 1969
W. H. Tabor and S. S. Hurt, III 4 Feb. 1970 42 p refs Sponsored by AEC
(ORNL-TM-2875) Avail: CFSTI

The ORR operated at an average power level of 30.0 MW for 86.9% of the time during July, August, and September of 1969. Twenty-eight fuel elements were declared spent while twenty-two new fuel elements were placed in service. The average burnup of the elements declared spent was 48.4%. There were six scheduled shutdowns during the quarter and two unscheduled; however, scheduled downtime accounted for 95.4% of the total. A major shutdown was conducted without lowering the reactor pool water and five experiments were handled. Drain lines at the south reactor demineralizer were changed so that regeneration procedures could be effected without entering the shielded demineralizer cell, should conditions warrant. The reactor mechanical components functioned quite normally, except for the south upper bearing assembly which was replaced because it could not be moved to the operate position. Author (NSA)

N70-28741# Oak Ridge National Lab., Tenn. Nuclear Safety Information Center.
INDEXED BIBLIOGRAPHY OF CURRENT NUCLEAR SAFETY LITERATURE, NO. 23
Feb. 1970 361 p refs
(Contract W-7405-eng-26)
(ORNL-NSIC-72) Avail: CFSTI

Publications in the field of nuclear safety are cited. Developments relevant to the analysis and control hazards associated with nuclear reactors, operations involving fissionable materials, and the products of nuclear fission are included. The citations are sorted into 18 categories and author and keyword indexes are provided. NSA

N70-28750# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
CALCULATION OF GAMMA DOSE RATES AT THE SURFACE OF PLUTONIUM OXIDE SOURCES
H. H. Van Tuyl Jan. 1970 94 p refs
(Contract AT(45-1)-1830)
(BNWL-1259) Avail: CFSTI

A computer program, PUSHLD, has been developed for calculating gamma dose rates at the surface of plutonium oxide sources. Radiation attenuation due to self-shielding and external shielding were included, along with secondary radiations from Compton scattering, X rays from photoelectric absorption, and electrons from photoelectric absorption. Sheilding curves are presented which may be used to determine the surface dose rate from a plutonium source of any isotopic composition and age. Calculated dose rates agreed within 20% with measured values for several plutonium isotopic compositions and three shield materials. Author (NSA)

N70-28776# Institutt for Atomenergi, Halden (Norway).
POST-IRRADIATION EVALUATION OF THE THIRD SWEDISH FUEL ASSEMBLY, IFA-21, IRRADIATED IN THE HALDEN BOILING HEAVY WATER REACTOR, 1967 1969
S. Djurle and H. Taylor Nov. 1969 42 p refs
(HPR-114) Avail: AEC Depository Libraries

Detailed post-irradiation examinations were performed on five fuel rods, irradiated in Boiling Heavy Water Reactor to a mean value of about 9650 MWd/tU. The fuel rods consisted of Zircaloy-2 cladding containing sintered UO sub 2 pellets enriched to 5 wt % U-235 of total uranium. Crack failures in four of the five rods are attributed to excessive plastic strains in the cladding; mode of reactor operation may have been a contributing factor to the failures. Author (NSA)

N70-28778# Argonne National Lab., Ill. Reactor Physics Div.
REACTOR-NOISE ANALYSIS IN THE TIME DOMAIN AEC Critical Review Series
Nicola, Pacilio (CNEN, Rome) Apr. 1969 102 p refs
(TID-24512) Avail: CFSTI

Reactor noise analysis techniques, results and analyses are reviewed in detail. Working equations and descriptions are given for the following types of noise analysis: the Rossi-alpha method; endogenous pulsed source method, autocorrelation and cross-correlation functions of the neutron counting rate, Feynman variance method, expected number of correlated pairs method, Bennett variance method, third-order analysis and the expected number of correlated-neutron-triplets method, covariance method, zero-count probability method, Polya-model method, other related probability methods, time interval from a random origin method, pulse to pulse time interval method, intermediate methods (even-or odd count, etc), polarity autocorrelation and cross-correlation method, and covariance method via polarity detection. NSA

N70-28779# Sandia Corp., Albuquerque, N.Mex.
AEROSPACE NUCLEAR SAFETY PROGRAM Quarterly Report, 1 Oct. 31 Dec. 1969
R. G. Illing, comp. Jan. 1970 79 p refs
(SC-PR-69-881) Avail: CFSTI

Impact tests were performed on five transit design fuel capsules. Ten solid propellant burn tests were conducted and data from nine tests are being compared to the theoretical thermal model, and agreement appears good. Five heat source capsules were impact tested using the Sandia sled track facility and four capsules broke open. An analysis was conducted to determine the

ablation which would occur during orbital decay and multiple orbit reentry of the isotopes hexagonal heat source. Molybdenum wires approximately 100 micrometers in diameter were exposed to alpha particle doses simulating Pu-238O2 cermet fuels 1 to 5 years old. Room temperature tensile tests on wires exposed to 5 year simulants indicated that the ultimate strength increased by approximately 3% while the percent elongation was reduced about 40%. Two ThO2 specimens were exposed to simulated reentry heat fluxes in the 40 kW arc tunnel for 30 sec. Neither specimen experienced any melt, ablation, or thermal fragmentation. NSA

N70-28780# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
STUDY OF THE SHAPING AND IRRADIATION OF URANIUM MONOCARBIDE, PART 1 Quarterly Reports No. 25 28, 1 Jul. 1967 30 Jun. 1968
J. Berthier et al Jun. 1968 60 p Transl. into ENGLISH from French report
(Contract EURATOM-7589)
(EURAEC-2083-Pt-1) Avail: CFSTI

Details concerning disassembly of capsules containing carbide specimens irradiated in SILOE 4 are presented. Similar information on capsules irradiated in SILOE 5 and EL 3 is included. NSA

N70-28781# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
STUDY OF THE SHAPING AND IRRADIATION OF URANIUM MONOCARBIDE, PART 2 Quarterly Reports No. 25 28, 1 Jul. 1967 30 Jun. 1968
J. Berthier et al Jun. 1968 52 p Transl. into ENGLISH from French report
(Contract EURATOM-7589)
(EURAEC-2083-Pt-2) Avail: CFSTI

Radiation testing of carbide specimens in EL 3 reactor is described along with similar tests in SILOE 6. Results of radiation testing of stainless steel-clad uranium carbide in SILOE are included along with information on fabrication of radiation capsules for EL 3. NSA

N70-28785# Atomic Energy Commission, Washington, D.C. Office of the Assistant General Manager for Reactors.
NUCLEAR REACTORS BUILT, BEING BUILT, OR PLANNED IN THE UNITED STATES AS OF 31 DECEMBER 1969
31 Dec. 1969 34 p
(TID-8200-Rev-21) Avail: CFSTI

Information about facilities in the U. S. capable of sustaining a nuclear chain reaction is tabulated. The name of the facility is listed with location, principal nuclear contractor, type, power, and startup date. The facilities are categorized as: civilian reactors, production reactors, military reactors, reactors for export, and critical assemblies. NSA

N70-28804# Battelle Memorial Inst., Columbus, Ohio.
AN EVALUATION OF THE APPLICABILITY OF EXISTING DATA TO THE ANALYTICAL DESCRIPTION OF A NUCLEAR-REACTOR ACCIDENT Quarterly Progress Report, Oct. - Dec. 1969
Wayne A. Carbiener and Robert L. Ritzman Jan. 1970 34 p refs
(Contract W-7405-eng-92)
(BMI-1877) Avail: CFSTI

The application of existing data to the analytical description of a nuclear reactor accident is discussed. Subjects covered are: (1) reactor fuel elements, (2) reactor safety, (3) boiling water reactors, and pressurized water reactors. Author

N70-28830# Idaho Nuclear Corp., Idaho Falls. National Reactor Testing Station.
RELATIVE IMPORTANCE OF DELAYED NEUTRONS IN FEW-GROUP REACTOR KINETIC CALCULATIONS
G. E. Putnam Jan. 1970 31 p refs
(Contract AT(10-1)-1230)
(IN-1356) Avail: CFSTI

It was found that a failure to account for the importance of the delayed neutrons relative to the prompt ones in few-group reactor kinetics calculations can cause large errors in the predicted asymptotic behavior. An approximate method is presented that removes the source of these errors by quite effectively accounting for the relative importance of the delayed neutrons in each neutron energy group. NSA

N70-28831# Battelle-Northwest, Richland, Wash. Control and Instrumentation Dept.
EVALUATION OF HYBRID COMPUTER PERFORMANCE ON A CROSS SECTION OF SCIENTIFIC PROBLEMS
R. D. Benham, ed. Jan. 1970 76 p refs
(Contract AT(45-1)-1830)
(BNWL-1278) Avail: CFSTI

The use of hybrid and small digital computers for application of scaled analog/digital simulation techniques is described. The hybrid computer software system is called SIMPL-1 and is implemented on a PDP-7 digital computer and an EASE 2133 analog computer designated PNL-1. The performance of the hybrid system is analyzed for the following problems: U.S. nuclear power economy; reactor vessel dynamics; nuclear plant dynamics; river water quality dynamics; metal annealing; reactor core design; steam particle deposition; fuel sintering; ultra-centrifuge data analysis; smoke pollution dynamics; ground water systems analysis; and two-group diffusion equation. NSA

N70-28835# Aerojet-General Corp., San Ramon, Calif. Nuclear Div.
DESIGN DEFINITION AND SAFETY EVALUATION STUDY OF A COMPACT Co 60 HEAT SOURCE IN SPACE Final Report
William G. Ruehle, Jr. Sep. 1969 194 p refs
(Contract AT(29-2)-2740)
(AGN-8341) Avail: CFSTI

The initial safety study of a Co-60 heat source in a space application considered the 30 kw(t) Co-60 kernel with organic Rankine or Brayton conversion in a 1-year, manned, earth orbit flight. Safety aspects from fuel production to post-flight kernel disposal were evaluated. The results were indicated no insurmountable safety problems. Further studies are necessary to define the best reentry package for the kernel and to measure molten soil, molten cobalt, and seawater corrosion of tungsten. Author (NSA)

N70-28839# Atlantic Richfield Hanford Co., Richland, Wash.
CRITICALITY HANDBOOK, VOLUME 2
R. D. Carter, G. R. Kiel, and K. R. Ridgway 23 May 1969 154 p refs
(Contract AT(45-1)-2130)
(ARH-600-Vol-2) Avail: CFSTI

Because of the increase in data presented, the Criticality Handbook has been issued as two volumes. Volume 1 includes administrative criteria, engineering data, and Part A of parameters of homogeneous systems. Volume 2 includes Parts B, C, and D of homogeneous systems parameters, interaction data, and data on poisoned systems. Loose-leaf pages containing additions and modifications of Volume 1 data are included with the Volume 2 publication. NSA

N70-28849# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
ANALYSIS OF FTR PHASE B CRITICAL EXPERIMENTS. PART 1: ZPR-3 ASSEMBLY 61
W. R. Young and R. A. Bennett Jan. 1970 91 p refs
(Contract AT(45-1)-1830)
(BNWL-1138) Avail: CFSTI

Critical experiments in support of the design of the Fast

Flux Test Reactor have been carried out in ZPR-III Assemblies 48, 48A, 51, and 52a, b, c, d, e, and f. The results and analysis of the experiments performed in Assembly 51, are presented. Author (NSA)

N70-28855# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Festkoerpper- und Neutronenphysik.
MEASUREMENT OF THE MASS DEPENDENCE ON ANISOTROPY AND YIELD OF PROMPT GAMMA RADIATION WITH THERMAL FISSION OF U 235 [MESSUNG DER MASSENABHAENGIGKEIT VON ANISOTROPIE UND AUSBEUTE DER PROMPTEN GAMMA STRAHLUNG BEI THERMISCHER SPALTUNG VON U 235]
Herwig Labus Feb. 1970 74 p refs In GERMAN
(JUL-643-FN) Avail: CFSTI

The yield and anisotropy of prompt gamma radiation were investigated as a function of the fission product mass for the thermal fission of U235. The fission products were produced in an external neutron beam from the experimental reactor Ju Alich 2. The target was a scintillator-disk, on which uranyl acetate had been deposited and the energies of the fission products were measured with four silicon-junction detectors. A photomultiplier tube was used to measure the times of flight. The fission product mass was derived from the energy and time-of-flight data, the prompt gamma radiation was registered with four plastic detectors. Author (ESRO)

N70-28857# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Reaktorentwicklung.
FUEL CYCLE OF A 600 MWe TWO-ZONE PEBBLE BED CORE WITH REFLECTOR CONTROL [BRENNSTOFFZYKLUS EINES 600 MWE-ZWEIZONEN-KUGELHAUFENCORES BEI REFLEKTORSEITIGER REGELUNG]
Hans Juergen Bock (Ph.D. Thesis--Tech Hochsch. Aachen) Mar. 1970 106 p refs In GERMAN
(JUL-645-RG) Avail: CFSTI

A fuel cycle was calculated for the stationary operation of a pebble bed reactor with a 600 MWe-core, so that the reactor could be reflector controlled. The reflector control was necessary because the control rods in the core lead to higher damage rate for the graphite pebbles during the frequent load changes. This approach necessitates a two-zone arrangement in the core with pebbles of different concentrations of fissionable material and thorium. Author (ESRO)

N70-28883# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Reaktorbauelemente.
APPARATUS AND DISSOLUTION METHODS FOR THE RELEASE OF FISSION GASES FROM IRRADIATED NUCLEAR FUELS [APPARATUREN UND LOESEVERFAHREN ZUR SPALTGASFREISETZUNG AUS KERNBRENNSTOFFEN]
Siegfried Kiessling and Markus Stoeppler Dec. 1969 27 p refs In GERMAN, ENGLISH summary
(JUL-627-RB) Avail: CFSTI

Two versions of a remote handling quartz or Duran apparatus for the dissolution of irradiated nuclear fuel samples consisting of UO2-pellets and coated particles are described. With the aid of especially purified helium, the released fission gases are transported to and adsorbed at a cooled filter. This is followed by gamma-spectrometric or mass spectrometric measurements. Some acid mixtures for dissolution of the described materials are compared and the results are discussed. Author (ESRO)

N70-28867# Bettis Atomic Power Lab., Pittsburgh, Pa.
GAUSSIAN QUADRATURE FOR CERTAIN INTEGRALS WITH WEIGHT FUNCTION EXP(-X SQUARED): LWBR DEVELOPMENT PROGRAM
N. M. Steen Jan. 1970 112 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-TM-773) Avail: CFSTI

Gaussian quadratures for the definite integrals are developed and the weights and abscissae tabulated to 15 places using up to 15 points for the semi-infinite interval. Weights and abscissae for quadratures are provided for the finite intervals with 0.3 < or = to b < or = to 1.0 in steps of 0.05, and for 0.05 < or = to b < or = to 0.25 in steps of 0.05. The basic notion of Gaussian quadrature is discussed and placed in a proper perspective in the class of interpolatory quadratures. Proof of convergence is given for a large class of functions which is not available in most works on the subject. Author (NSA)

N70-28872# Atomics International, Canoga Park, Calif. Liquid Metal Engineering Center.
LIQUID METAL ENGINEERING CENTER (LMEC) Semiannual Technical Progress Report, Jan. - Jun. 1969
30 Nov. 1969 253 p refs
(Contract AT(04-3)-700)
(LMEC-69-30) Avail: CFSTI

Activities at the LMEC were directed toward support of the LMFBR during the period. Progress is reported on support projects in codes and standards, maintenance and malfunction analysis, quality assurance, operation of sodium components test installation, liquid metals information center, sodium pump test facility, sodium seal testing, sodium bearing testing, precision mechanisms testing, steam generator performance, instrument testing, metallurgical research, and operation of test loops. NSA

N70-28899# California Univ., Lawrence Radiation Lab.
MIRROR SYSTEMS: FUEL CYCLES, LOSS REDUCTION, AND ENERGY RECOVERY
R. F. Post 8 Sep. 1969 51 p refs Presented at the Intern. Conf. on Nucl. Fusion Reactors, Culham, England, 17-19 Sep. 1969 Supported by AEC
(UCRL-71753; Conf-690901-7) Avail: CFSTI

The problem of maximizing the usable fusion energy from mirror-confined plasmas is considered. Two approaches are emphasized, as follows: (1) optimization of the fusion energy release by adjustment of the fuel plasma composition, ion temperature and operating cycle, together with exploitation of neutron-multiplying reactions in the blanket, and (2) employment of direct energy recovery techniques to improve injection efficiency and to recover energy in electrical form from the end loss particle flux. Approach (1) using DT reactions, followed by neutron multiplication and capture in sodium or aluminum is predicted to lead to steady state energy releases of about 30 to 35 MeV per reaction, depending on the tritium breeding ratio is required. With a modified DD cycle, where breeding is not required, total energy releases of about 18 MeV per deuteron should be obtainable by a similar technique. Author (NSA)

N70-28901# General Electric Co., Sunnyvale, Calif. Breeder Reactor Development Operation.
SODIUM-COOLED REACTORS, FAST CERAMIC REACTOR DEVELOPMENT PROGRAM Quarterly Report, Aug. - Oct. 1969
Nov. 1969 97 p refs
(Contract AT(04-3)-189)
(GEAP-10028-32) Avail: CFSTI

The fast ceramic reactor development program is discussed. Subjects presented are: (1) fast ceramic reactor, (2) incoloy 800, (3) plutonium oxides, (4) reactor fuel elements, (5) reactor safety, and (6) stainless steels. Emphasis is placed on radiation effects and transient overpower effects. Author (NSA)

N70-28907# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Reaktorwerkstoffe.
REQUIREMENTS OF COOLING GAS FOR CLOSED REACTOR LOOPS, ESPECIALLY FOR THE CARBON DIOXIDE LOOP LV5 AND THE HELIUM LOOP LV17

[ANFORDERUNGEN AN KUEHLGAS FUER BESTRAHLUNGSKREISLAEUFE INSBESONDERE FUER DAS CO2-LOOP LV5 AND DAS HE-LOOP LV17]
Wolfgang Krug Dec. 1969 13 p In GERMAN
(JUL-629-RW) Avail: CFSTI

Gases such as CO2 and He, used as coolants in closed reactor loops, are exposed to reactor radiation. Isotopes are formed by neutron capture and may be radioactive and endanger the operating environment of the reactor, in which case the loop components have to be shielded. To measure the amount of contaminants, the coolant helium is sent through a trap, which absorbs the contaminants, and after a certain concentration time the trap is baked out and analyzed in a gas chromatograph. Carbon dioxide coolant is conducted through potassium hydroxide, which gives potash and leaves residual gases for analysis by gas chromatography. ESRO

N70-28908# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Reaktorwerkstoffe.
THERMODYNAMIC TRIALS FOR THE HELIUM-COOLED REACTOR FUEL ELEMENT LOOP LV17 WITH NATURAL CIRCULATION COOLING [THERMODYNAMISCHE VORVERSUCHE FUER DAS HE-GEKUEHLTE BRENNELEMENTLOOP LV 17 MIT NATURUMLAUFKUEHLUNG]
Wolfgang Krug Dec. 1969 30 p In GERMAN
(JUL-630-RW) Avail: CFSTI

For irradiation tests of high temperature reactor fuel elements, especially spherical fuel elements, a helium natural circulation loop was constructed, in which the heat transport of the fuel element takes place by natural circulation of highly pressurized helium inside the reactor test range. ESRO

N70-28910# Kernforschungsanlage, Juelich (West Germany). Zentrallab. fuer Chemische Analyse.
APPARATUS AND METHODS FOR THE PREPARATION OF IRRADIATED AND NON-IRRADIATED NUCLEAR FUEL SAMPLES FOR MASS SPECTROMETRIC DETERMINATION OF URANIUM ISOTOPE COMPOSITION [APPARATIVE ANORDNUNGEN UND VERFAHREN ZUR VORBEREITUNG BESTRAHLTER UND UNBESTRAHLTER KERNBRENNSTOFFPROBEN ZUR MASSENSPEKTROMETRISCHEN BESTIMMUNG DES URAN-ISOTOPENVERHAELTNISSES]
Markus Stoeppler Dec. 1969 56 p refs In GERMAN; ENGLISH summary
(JUL-633-CA) Avail: CFSTI

Solutions of uranylnitrate, for mass spectrometric determinations of the isotopic ratios of uranium, were obtained with high radiochemical and chemical purity. Apparatus and techniques for the processing of UO2, UC2, UO2/ThO2, and UC2/ThC2 were developed. Remote handling dissolution and decontamination of these solutions and the purification procedures are discussed. It was possible to obtain average decontamination factors for the uranium solution from less than 10,000 to less than 10 to the 9th power for thorium, iron, protactinium, and the most important fission products. The spectrophotometric and colorimetric procedures used for uranium and thorium and mixtures of both elements are also described. Author

N70-28936# Atomics International, Canoga Park, Calif.
A 1000-MWe LIQUID METAL FAST BREEDER REACTOR FOLLOW-ON STUDY. TASK 4 REPORT: RESEARCH AND DEVELOPMENT PROGRAM
[1969] 413 p refs Prepared for Argonne Natl. Lab.
(AI-AEC-12793) Avail: CFSTI

The identification and definition of the research and development program for the design concept for a 1000 MW(e) liquid metal cooled reactor are detailed. The scope of the R&D program is defined, individual task costs are estimated, and priorities are assigned. NSA

N70-28942# General Electric Co., Sunnyvale, Calif. Breeder Reactor Development Operation.
PLUGGING INDICATOR OPERATION: SODIUM MASS TRANSFER PROGRAM
G. D. Collins Sep. 1969 36 p refs
(Contract AT(04-3)-189)
(GEAP-10048) Avail: CFSTI

Research directed toward development of plugging indicators for sodium loops is reviewed. Discussions of plugging indicator operation and the double plugging break in high-temperature sodium systems are discussed. Details of plugging indicator design and operation in mass transfer loops are given. Information is included on automatic oscillating plugging indicators. NSA

N70-28948# General Electric Co., Sunnyvale, Calif. Advanced Products Operation.
THE ROLE OF FISSION PRODUCTS IN THE SWELLING OF IRRADIATED UO2 AND (U, Pu)O2 FUEL
F. Anselin Jan. 1969 37 p refs
(Contract AT(04-3)-189)
(GEAP-5583) Avail: CFSTI

The contribution of solid fission products to the swelling of irradiated UO2 or mixed UO2 – PuO2 fuels was investigated. A model was devised to account for the portion of the increased volume which is due to accumulation of solid fission products as a function of irradiation exposure. The analytical steps involved in synthesis of the model are described. NSA

N70-28953# Oak Ridge National Lab., Tenn.
SSF: A FORTRAN 4 PROGRAM FOR COMPUTING SELF-SHIELDING FACTORS
R. S. Carlsmith, D. Steiner, and J. L. Lucius (Union Carbide Corp., Oak Ridge, Tenn.) 19 Dec. 1969 15 p ref Sponsored by AEC
(ORNL-TM-2786) Avail: CFSTI

A computer program which determines flux ratios and self-shielding factors for a 2 region cell is described. The self-shielding factors may be input to a GAM-II calculation by use of an automated linkage option. The use of this program requires a familiarity with the GAM-II equations and input (NSA)

N70-28957# Brookhaven National Lab., Upton, N.Y.
A REVIEW OF THE CURRENT STATUS OF RESEARCH ON THE CHEMICAL AND PHYSICAL ASPECTS OF LIQUID-METAL-COOLED FAST BREEDER REACTOR SAFETY. PART 1: FISSION PRODUCT BEHAVIOR IN SODIUM
A. W. Castleman, Jr. [1969] 41 p refs Submitted for publication Sponsored by AEC
(BNL-14278) Avail: CFSTI

The current status of research on the chemical and physical aspects of liquid-metal-cooled fast breeder reactor safety is reviewed. Present knowledge on the behavior of fission products comprising the noble gases, halogens, alkali metals, alkaline earth metals, and rare earths, in Na systems is summarized. Considerable information is available on their behavior in the event of minor accidents in which deposition within the reactor primary system and vaporization to the cover-gas would be of concern to the reactor operator. Data on the factors controlling their chemical states and rates of vaporization are discussed. The thermodynamic data available for many of the fission product-sodium systems are shown to be useful in estimating fission product partial pressures above liquid sodium and the maximum extent of vaporization under conditions such that sodium vaporization is significant. Author (NSA)

N70-28958# Battelle-Northwest, Richland, Wash. Reactor and Plant Technology Dept.
ASPRIN: A COMPUTER CODE FOR PREDICTING REACTOR VESSEL RESPONSE TO HYPOTHETICAL MAXIMUM ACCIDENTS ON FAST REACTORS
G. L. Fox Dec. 1969 79 p refs
(Contract AT(45-1)-1830)
(BNWL-1166) Avail: CFSTI

Current nuclear reactor design procedure postulates a maximum reactor excursion in order to test containment. The maximum cover loadings are assumed to result from a coolant slug propelled against the cover by blast pressure in the core region. A method for predicting these head loadings is described. The analytical method utilizes combinations of 1 dimensional Newtonian models in radial and axial directions to simulate the reactor, cover, and holddown structure. Wave phenomena are not considered and deformations are assumed to occur from quasi-steady pressures. The equations have been programmed and output information consists of gross vessel and cover displacements, velocities, stresses, strains, and the blast energy distribution. A sample problem is included which demonstrates the effect of vessel parameters on the cover loading problem. Author (NSA)

N70-28965# AEG-Kernenergieanlagen, Frankfurt am Main (West Germany).
STABILITY STUDIES FOR BOILING WATER REACTORS Final Report, 1 Apr. 1964 - 30 Jun. 1968
30 Jun. 1968 311 p
(Contracts EURATOM-020-64-4-TEED/RD/; EURATOM-085-66-1-TEED/RD/)
(EURAEC-2092; EUR-4012; AEG-E-31/E-1201) Avail: CFSTI

The steady state and dynamic behavior of an electrically heated channel with two phase flow, typical for BWR's with forced flow, has been investigated for flow and power perturbations by measuring the frequency response of the local voids along the channel. The frequency response: power-local void was obtained both for constant flow and for constant channel pressure drop. Integration of the local voids led to the total void. These experimental results were compared with calculations of the AMOK-L-program, which is based on the analytical model of Kirchenmayer. The model needs as input constants which are derived from empirical slip and pressure drop correlations. Special steady state measurements provided the needed information. The overall agreement between experimental and theoretical local void revealed disagreement in the high frequency region. By modification of the total void theory good agreement in both phase and amplitude could be achieved. Author (NSA)

N70-29023# Atomic Energy Commission Research Establishment, Riso (Denmark). Metallurgy Dept.
EQUIPMENT FOR DETERMINATION OF FUEL DENSITY IN FUEL PINS
W. Batsberg Pedersen, O. Toft Soerensen, and L. Loevborg Nov. 1969 19 p refs
(RISO-209) Avail: CFSTI

A densitometer using the absorption of gamma radiation from a 200 mCi Cs-137 source was designed for measurement of the axial density distribution in fuel pins. A description is given of the principle involved, the equipment designed, and the tests carried out to determine the optimum measuring conditions. Some typical measurements of the density distribution in vibratory-compacted and pellet fuel pins are given. Author (ESRO)

N70-29024# Institutt for Atomenergi, Halden (Norway).
COVARIANCE ANALYSIS IN THE DESIGN OF MODELS AND MONITOR PATTERNS FOR ON-LINE COMPUTER CONTROL OF MULTIVARIABLE PROCESSES
Rainer Grumbach Aug. 1969 31 p refs
(HPR-106) Avail: AEC Depository Libraries

A method for selection of optimum control processes in an operating reactor is given. The flow diagram for both the emergency action and normal operating control modes is shown. Mathematical models are developed for the observation-decision process to be initiated by the controller; the covariance method is used for these developments. NSA

N70-29072# Oak Ridge National Lab., Tenn.
REACTOR CHEMISTRY DIVISION Annual Progress Report, Period Ending 31 Dec. 1968
Feb. 1970 174 p refs
(Contract W-7405-eng-26)
(ORNL-4400) Avail: CFSTI

Progress is reported on: chemical studies of molten salt systems, behavior of fission products and protactinium in molten fluorides, corrosion and chemical behavior in reactor and desalination environments, electric conductance of aqueous electrolytes at 800 C and 4000 bars, physical chemistry of high-temperature aqueous solutions, diffusion processes, irradiation behavior of high-temperature fuel materials, nuclear safety tests in major facilities, aerosol behavior, behavior of elemental and combined iodine, special nuclear safety studies, effects of neutron irradiation on refractory materials, effects of radiation on organic materials, and surface chemistry. NSA

N70-29102# Commissariat a l'Engerie Atomique, Cadarache (France). Centre de'Etudes Nucleaires.
OSIRIS-TYPE CORE EXPERIMENTS PERFORMED ON THE REACTOR CABRI [COMPTE RENDU DES EXPERIENCES COEUR TYPE OSIRIS FAITES SUR LA PILE CABRI]
Pierre Dutraive and Alain Tattegrain Oct. 1969 79 p refs in FRENCH
(CEA-N-1205) Avail: AEC Depository Libraries

Theoretical and experimental results of tests performed on the reactor Cabri for the purpose of raising the power of the reactor Osiris are given. The main items are the determination of the highest possible power and the core behavior under accidental stopping of coolant flow. Author (NSA)

N70-29104# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Reaktorentwicklung.
EXPERIMENTAL DETERMINATION OF RADIAL SOLID FISSION PRODUCT AND HEAVY METAL CONCENTRATION PROFILES IN THE ENVELOPE OF SPHERICAL FUEL PARTICLES FOR HIGH TEMPERATURE REACTORS [EXPERIMENTELLE BESTIMMUNG RADIALER KONZENTRATIONSPROFILE FESTER SPALTPRODUKTE UND SCHWERMETALLE IN DER UMHUELLUNG KUGELFOERMIGER BRENNSTOFFTEILCHEN FUER HOCHTEMPERATURREAKTOREN]
Karl Wilhelm Baurmann (Ph.D. Thesis--Tech. Hochsch. Aachen) Feb. 1970 184 p refs In GERMAN
(JUEL-639-RG) Avail: CFSTI

In the framework of the development of gas-cooled high-temperature reactors, investigations were conducted on the transport of solid fission products and uranium, thorium, and protactinium inside the fuel particle coatings consisting of pyrolytic graphite. A main item of the investigation was the development of a suitable chemical of the radial single nuclide concentration profiles for one single particle or for greater particle quantities up to a total weight of 1 gram, was made possible. Author (ESRO)

N70-29126# General Electric Co., Sunnyvale, Calif. Breeder Reactor Development Operation.
MECHANICAL PROPERTIES OF IRRADIATED TYPE-304 AND TYPE-316 STAINLESS STEEL IN FAST REACTORS
F. A. Comprelli, H. J. Busboom, and M. F. Gebhardt Jun. 1969 23 p refs
(Contract AT(04-3)-189)

(GEAP-10062) Avail: CFSTI

Data published to Nov. 1968 on the mechanical properties of irradiated Types 304, 316, and 316L stainless steel have been compiled and analyzed. Curves are given for variation of yield stress, ultimate tensile stress, uniform elongation, and total elongation as a function of test temperature. The property limits suggested for use at total fluences above 10 to the 22nd power nvt include yield stress at 0.2% offset: 44,000 psi at 500 C, 31,000 psi at 600 C, and 20,000 psi at 700 C; ultimate stress: 58,000 psi at 500 C, 46,000 psi at 600 C, and 30,000 psi at 700 C; uniform elongation: less than 1%; total elongation: less than 1%; minimum creep rate: unchanged to slightly increased by irradiation; time to rupture: reduced significantly by irradiation; and creep strain to fracture: as low as 1%. NSA

N70-29129# Battelle-Northwest, Richland, Wash.
PLUTONIUM UTILIZATION PROGRAM Quarterly Report, Sep. – Nov. 1969
Jan. 1970 74 p refs
(Contract AT(45-1)-1830)
(BNWL-1289) Avail: CFSTI

Brief accounts are given of work completed in reactor neutronics, fuels technology, reactor safety, and plutonium recycle test reactor (PRTR) deactivation. Reactor neutronics tasks discussed are: nonlinear least squares data analyses, UO2 and UO2-PuO2 fuel H2O moderator loadings, analysis of one and two-dimensional cell representations for cluster geometry fuel, and comparison of relative reaction rate data on particle size in UO2-PuO2 fuel rods. Fuels technology work covers: PRTR fuel evaluations, defect testing, instrumented fuel tests, high exposure plutonium studies, plutonium fuel dissolution, and plutonium fuels decontamination. E.C.

N70-29136# Battelle-Northwest, Richland, Wash.
FAST FLUX TEST FACILITY Quarterly Technical Report, Sep. – Nov. 1969
C. P. Cabell, comp. Jan. 1970 182 p refs
(Contract AT(45-1)-1830)
(BNWL-1275) Avail: CFSTI

Fast Flux Test Facility program technology is summarized. Highlights include: the FFTF fuel assembly duct material was changed to Type 316 SS. Tests are in progress to estimate the potential for caustic stress corrosion cracking in the Type 304 SS reactor guard vessel. A transient model simulating reactor core design and primary loop configuration was developed and programmed. Radiation levels in heat transport cells are projected as less than 100 mrem/hr. The xenon gas tagging concept for location of failed fuel in the FTR was evaluated. An alpha particle counting system was chosen to monitor airborne plutonium collected on filters. A method was developed for quantitative analysis of fuel pellet homogeneity through electron microprobe scanning. Critical approach and exponential experiments to measure material bucklings, extrapolation distances, and critical masses as a function of lattice spacing for PuO2-UO2 fuel pins in water are described. Results of a neutronics study of the adequacy of peripheral control rod worth measurements in ZPR-3 assembly 56B are discussed. E.C.

N70-29161# General Electric Co., Cincinnati, Ohio. Nuclear Systems Programs.
AEC FUELS AND MATERIALS DEVELOPMENT PROGRAM Progress Report
30 Jun. 1969 409 p refs
(Contract AT(40-1)-2847)
(GEMP-1013; PR-79) Avail: CFSTI

Progress is reported on physicochemical studies of clad uranium oxide under accident conditions, fast breeder advanced fuel element cladding fabrication, advanced long-life reactor fuel cladding and structural materials development, plastic fatigue properties of heat-resistant alloys, advanced pressure vessel materials, fast breeder reactor control, shield, and reflector materials development, radiation effects on fast reactor cladding and structural materials, high-temperature studies of uranium based fuels, refractory metal fuel element research, and testing and evaluation of in-pile specimens. NSA

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N70-27806# Naval Academy, Annapolis, Md. Michelson Physical Lab.
THE ACOUSTIC RADIATION PRESSURE ON A LIQUID DROPLET IN A STATIONARY SOUND FIELD
Lawrence A. Crum Feb. 1970 57 p refs
(AD-702419; C-1) Avail: CFSTI CSCL 20/1

The subject of the report is the force exerted on a spherical inclusion in a liquid by an acoustic stationary wave. Experimental and theoretical values are presented for the minimum acoustic pressure amplitudes required to trap small, individual droplets of various liquids near a pressure antinode in a stationary sound field in a cylinder filled with water. The liquids used were paraldehyde, hexane, benzene, toluene, chlorobenzene, and carbon tetrachloride. Droplet radii ranged from 400 to 800 micrometers and acoustic pressure amplitudes ranged from 1 to 15 bars. Calculated and observed values are in agreement if the compressibility of the liquid droplets is considered. Author (TAB)

N70-27865# Avco Government Products Group, Lowell, Mass. Applied Technology Div.
THE ELECTRODELESS SPARK UNDERWATER SOUND SOURCE Summary Technical Report
H. A. Wright, Jr. 8 Jan. 1970 40 p refs
(Contract Nonr-4389(00))
(AD-700441; AVATD-0200-69-RR) Avail: CFSTI CSCL 20/1

The electrodeless spark sound source is an impulsive electro-acoustic transducer. It generates a broadband impulse which is typically several tens of microseconds in duration. The electrodeless spark principle is described, and the results of parametric studies presented. It is found that the device is long lived, its emitted pressure waveform can be readily controlled, the emitted waveform is extremely reproducible, and the bubble pulse emission can be virtually eliminated. A discussion of several specific device configurations relates the waveform of the emitted pressure to both the electric and the geometric parameters used. Author (TAB)

N70-27875# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.
EXACT CONFORMALLY-PLANE SOLUTION OF THE EINSTEIN EQUATIONS FOR THE NON-STATIC AXIAL FIELD SYMMETRY
N. P. Bondarenko and P. K. Kobushkin 1969 31 p refs
(ITF-69-61) Avail: AEC Depository Libraries

The exact solution of the equations of the general theory of relativity for the case of the conformally plane field of the non-static axial symmetry is found. It is shown that the obtained equation: (1) can describe the metric of the non-static anisotropic material model with the homogeneous distribution of matter and the inhomogeneous distribution of pressure, (2) allows the possibility of the oscillations with the existence of the regular minimum of radius of the corresponding model, and (3) in the limiting case the

solution describes the non-static cosmological Einstein Sitter's model. The axial character of the model is connected with the postulated density of the field angular momentum. Author (NSA)

N70-27894# California Univ., Livermore. Lawrence Radiation Lab.
DETERMINATION OF ACOUSTIC VELOCITIES AND DYNAMIC ELASTIC MODULI IN ROCKS UNDER PRESSURE
R. N. Schock, H. Louis, and E. M. Lilley 18 Sep. 1969 38 p refs
(UCRL-50750) Avail: CFSTI

A fundamental need of the Plowshare and Whitney Test Programs is a capability to predict the effects from the detonation of a buried explosive. To adequately predict these effects, a reasonable equation of state must be obtained. As part of this program, acoustic velocities were measured and elastic moduli was computed. The theory of elastic strain in an isotropic medium relates the acoustic velocities and the elastic moduli in such a manner that a determination of the compressional and shear velocities is sufficient to allow the calculation of all elastic properties. These measurements were made as a function of confining pressure up to 10 kb to provide insight into the response of the rock medium to a stress wave. To determine the velocity of propagation, an audio signal was generated by applying an electrical pulse to a transducer; the time necessary for this signal to traverse the cylindrical rock specimen and activate another transducer was measured. Author (NSA)

N70-27902# California Univ., Berkeley. Lawrence Radiation Lab.
FAR-INFRARED GENERATION BY NONLINEAR OPTICAL INTERACTION
Dillard Wayne Faries (Ph.D. Thesis) Aug. 1969 89 p refs
(Contract W-7405-eng-48)
(PB-187817; UCRL-19059) Avail: CFSTI CSCL 20F

Tunable narrow-band far-infrared generation by nonlinear optical mixing is achieved for the first time. Two ruby lasers, simultaneously Q-switched by a single rotating prism, and operated at different temperatures are used as primary sources. The laser beams are combined and mixed in a nonlinear crystal, primarily lithium niobate. The nonlinear polarization at the difference frequency induced in the crystal acts as a source for generating far-infrared. Calculations for the power output including effects of laser mode-structure, absorption, birefringence, boundary conditions and phase-matching are presented and compared with experimental results. Author (USGRDR)

N70-27918# Rochester Univ., N.Y. Dept. of Physics and Astronomy.
COHERENCE PHENOMENA IN ELECTROMAGNETIC RADIATION Interim Scientific Report, 1 Oct. 1968 - 30 Sep. 1969
Emil Wolf Nov. 1969 13 p refs
(Grants AF-AFOSR-1404-68; AF-AFOSR-1404-68(A))
(AD-700425; AFOSR-70-0142TR; ISR-2) Avail: CFSTI CSCL 20/5

A brief summary is given of research which was chiefly concerned with the following areas: phase-space techniques in quantum mechanics with special reference to the study of coherence properties of light; operator ordering techniques, inverse diffraction and scattering. Author (TAB)

N70-27966# Defense Documentation Center, Alexandria, Va.
FARADAY ROTATION, VOLUME 1: A DDC BIBLIOGRAPHY, MARCH 1961 - JULY 1969
Feb. 1970 108 p refs
(AD-700600; DDC-TAS-70-7-1-Vol-1) Avail: CFSTI CSCL 20/6

References in this bibliography deal with Faraday Rotation, which is rotation of the plane of vibration when polarized light passes through a strong magnetic field. In most of the entries in this bibliography, Faraday Rotation is used either to investigate the optical and magnetic properties of various materials or to determine the electron density of the ionosphere. TAB

N70-28017# Naval Postgraduate School, Monterey, Calif.
STUDY OF THE WATER-FILLED CYLINDRICAL ACOUSTICAL RESONATOR FOR THE DETERMINATION OF LOW FREQUENCY ATTENUATION IN SEA WATER
David Edmund Lilly (M.S. Thesis) Dec. 1969 43 p refs
(AD-702065) Avail: CFSTI CSCL 20/1

A pair of large cylindrical Pyrex vessels were water-filled to various heights and the acoustic damping constants and resonant frequencies determined from 3 to 15 kHz. Evacuation of a chamber surrounding the cylinder and increase of the ratio of water height to vessel radius, h/R, greater than unity are both shown to reduce the relative ambient loss of the resonant system. Although the highest Q (20,800) is much less than attained with spherical vessels, it is believed that with thinner walled vessels the extrapolation method of accounting for the influence of the boundaries will permit laboratory measurement of the low frequency attenuation of sound in sea water. Author (TAB)

N70-27999*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CRITICAL LEVITATION LOCI FOR SPHERES ON CRYOGENIC FLUIDS
R. C. Hendricks and S. A. Ohm [1970] 31 p refs
(NASA-TM-X-52804) Avail: CFSTI CSCL 20D

The forces and governing equations for spheres floating on a fluid of lower specific gravity are examined. Three similarity parameters, Bond number, component density ratio of the sphere to the fluid, wetting angle, and the critical levitation locii established, are sufficient to determine whether or not the sphere will float. Data appear in good agreement with the analysis for a limited range of Bond numbers and a wetting angle of pion. Author

N70-28021# Brown Univ., Providence, R.I. Div. of Applied Mathematics
NONLINEAR DIFFRACTION Technical Report
Frederic E. Bisshopp Dec. 1969 30 p refs
(Contract Nonr-562(42))
(AD-702071; TR-10) Avail: CFSTI CSCL 20/6

The equations governing the geometrical approximation for nonlinear wave propagation that were derived in a previous paper of this series are used here to construct a special solution that describes diffraction at an edge. The effect described is a purely nonlinear one, having nothing whatever to do with physical optics or physical acoustics - it disappears in the limit where the energy of the local wave approaches zero. Consequently, it can be a dominant effect only when the energy is relatively high, as perhaps in a laser beam. Author (TAB)

N70-28060# RAND Corp., Santa Monica, Calif.
LORENTZ INVARIANCE IN A GRAVITATIONAL FIELD
Robert L. Kirkwood Feb. 1970 38 p refs
(Contract F44620-67-C-0045)
(AD-702427; RM-6064-PR) Avail: CFSTI CSCL 20/10

Interpretation of gravity in terms of an ether flow makes it possible to separate the metric coefficients which describe the intrinsic properties of space and time from those that describe the gravitational field. This separation, in turn, suggests a large-scale invariance in the gravitational field which is quite similar to the one that exists in the electromagnetic field in the special theory. The infinitesimal form of the generalized Lorentz transformation is determined in a Newtonian field by the fact that the three-dimensional geometry remains Euclidean under the transformation. The finite form is then determined so that the transformations form a group, and the group is found to be the usual Lorentz group. The transformation is then extended to apply to fields which are not necessarily Newtonian. Author (TAB)

N70-28189 Stanford Univ., Calif.
THE EFFECT OF INTERNAL STRESS ON REMANENT MAGNETIC PROPERTIES OF NICKEL
Peter Northrop Shive (Ph.D. Thesis) 1968 63 p
Avail: Univ. Microfilms: HC $3.60/Microfilm $3.00 Order No. 69-8267

In order to assess the influence of internal stress on magnetic properties of interest in paleomagnetic research, experimental investigations were made on six strained samples from a nickel single crystal. The samples were (100) discs per sq cm. Saturation isothermal remanent magnetization (IRM) and magnetic coercive force were measured on a vibrating sample magnetometer and found to be proportional to the square root of the dislocation density. A theory is developed to explain the saturation IRM in terms of interaction between crystal dislocations and magnetic domain walls. A model is proposed to explain roll magnetic anistropy in terms of uniaxial anistropy imposed by preferentially oriented dislocations. Samples with different strain were found to react differently to thermal demagnetization of remanence. Dissert. Abstr.

N70-28202# Ballistic Research Labs., Aberdeen Proving Ground, Md.
COHERENT LIGHT PROPAGATION THROUGH A TURBULENT ATMOSPHERE: MEASUREMENTS OF THE OPTICAL FILTER FUNCTION Memorandum Report
Peter M. Livingston, Paul H. Daitz, and Ernest C. Alcaraz Oct. 1969 53 p refs
(AD-699802; BRL-MR-2018) Avail: CFSTI CSCL 20/6

Two He-Ne lasers operating at 6328 A have been utilized to make simultaneous measurements of the effects of scintillation over homogeneous optical paths of 650 and 1300 m to study the transfer of coherent radiation through a turbulent medium. At the path terminus, multiple sampling of each laser beam was effected using a photo-optical technique which records a 61-cm cross section of an optical beam. Concurrent with the optical data, wind-speed and direction recordings were made at multiple points along the optical path in order to estimate the homogeneity of meteorological conditions. Near the path terminus, measurements of wind shear and temperature lapse were taken. In addition, high-speed thermometry techniques were utilized to compute one-dimensional temperature spectra as well as the thermal structure coefficient CT. Data were gathered during temperature-lapse, neutral, and inversion conditions. Log-irradiance scans derived from the optical data were used to compute log-irradiance power spectra, variance, and other statistical quantities. Using these optical and meteorological data, optical filter functions were then calculated for spatial frequencies above 87 c/m and are used to compare with current theories. The saturation of the log-irradiance data is again observed, and the isotropy of the irradiance fluctuations is examined. Author (TAB)

N70-28248# Singer-General Precision, Inc., Little Falls, N.J. Kearfott Div.
FLUERIC NOISE STUDY IN SINGLE AND CASCADE FLUID AMPLIFIERS Final Report, Jan. 1968 – Aug. 1969
James Donoghue, Lawrence S. Galowin, Frank Morici, Edward L. Rakowsky, and Fred Thau Aug. 1969 106 p refs
(Contract N00014-68-C-0263)
(AD-700764; GPSI-1590-6903) Avail: CFSTI CSCL 13/7

An investigation of a method to predict the noise response within fluid amplifiers was undertaken using well established analytical techniques from electrical circuit network theory. The synthesis of a flueric analog amplifier mathematical model was based upon establishing an equivalent electrical circuit. Appropriate noise voltage and current generators were employed to account for the experimentally observed noise responses of the flueric elements. The general approach was based upon the assumption that a vacuum tube equivalent circuit could be applied for the representation of the noise response of analog flueric elements. Initially, to accomplish this, justification was sought for the electrical analogy adopted by other investigators and presumably found valid by comparison with test data for the deterministic case. Subsequently, the deterministic gain of a single amplifier was determined experimentally at different supply pressures. Experimental results contradicted the predicted response of the electrical equivalent circuit which indicated that the cross-over frequency and the magnitude of the gain for frequencies below cross-over should both be directly proportional to supply pressure. It was hypothesized that the discrepancies between experimental and calculated deterministic gains would disappear if the circuit parameters were calculated considering the Reynolds number held fixed as supply pressure varied. Experimentally determined amplifier gains for three different supply pressures, but with constant output channel Reynolds number, were obtained. Author (TAB)

N70-28325# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
EDDY MACH WAVE NOISE FROM A SIMPLIFIED MODEL OF A SUPERSONIC MIXING LAYER
H. S. Ribner Oct. 1969 19 p refs
(Grant AF-AFOSR-0672-67)
(AD-700775; UTIAS-TN-146; AFOSR-69-2145TR) Avail: CFSTI CSCL 20/1

A simplified flow model is presented for simulating features of noise generation by supersonic jets and rockets. Eddy Mach waves appear as a consequence of balancing internal and external pressures, and noise power may be estimated. Specifically, the turbulent mixing layer of a supersonic jet is modeled as a layer of two-dimensional square eddies; this separates the main flow from fluid at rest and moves at an intermediate speed. (In an improved model the square eddies are replaced by a turbulent flow layer constrained by plane interfaces). The initially plane interfaces, because of unopposed internal pressures, will ripple slightly such that Mach waves arise and effect a pressure balance. The Mach wave noise pattern is readily calculated as well as the acoustic energy flux. Author (TAB)

N70-28379# National Bureau of Standards, Washington, D.C.
ON ABSOLUTE MEASUREMENT
N. Ernest Dorsey and Churchill Eisenhart *In its* Precision Meas. and Calibration, Vol. 1 Feb. 1969 p 49-55 Reprinted (See N70-28376 14-19)
Avail: SOD $5.50

Excerpts from a previously published article on the absolute measurement of the velocity of light by Dorsey are presented. The selections include brief discussions on the theory of errors, averaging, quasesitum, definitive value, dubiety, and experimental procedure and reporting. N.E.N.

N70-28384# National Bureau of Standards, Washington, D.C.
EXPERIMENTAL STATISTICS. CHAPTER 11: GENERAL CONSIDERATIONS IN PLANNING EXPERIMENTS
Mary G. Natrella *In its* Precision Meas. and Calibration, Vol. 1 Feb. 1969 p 81-85 refs (See N70-28376 14-19)
(NBS-Handbook-91) Avail: SOD $5.50

Basic principles in statintical design of experiments are summarized. The use of proper experimental patterns in evaluating factors which are varied in a controlled fashion is described. Information is given on the effects of background variables and random variables. Replication of certain measurements and difficulties in experimental design language are mentioned. N.E.N.

N70-28389# National Bureau of Standards, Washington, D.C.
PHYSICAL MEASUREMENTS AND EXPERIMENT DESIGN
W. J. Youden *In its* Precision Meas. and Calibration, Vol. 1 Feb. 1969 p 117-130 refs Repr. from Colloq. Int. Cent. Nat. Rech. Sci. (France), no. 110, 1961 p 115-128 (See N70-28376 14-19)
Avail: SOD $5.50

Each field of experimental inquiry poses problems that are characteristic of the field. Research programs are, in general, planned to take advantage of the special features that broad classes of problems present. One broad class of problems deals with the determination of physical constants and the calibration of instruments. The statistical aspects of physical measurements are discussed, and some experimental programs are suggested that may be useful to those concerned with the determination of physical constants and with calibration procedures. Author

N70-28409# Bell Telephone Labs., Inc., New York.
QUALITY OF OBSERVATIONS: ON THE MEANING OF PRECISION AND ACCURACY
R. B. Murphy *In* NBS Precision Meas. and Calibration, Vol. 1 Feb. 1969 p 357-360 ref Presented at 63d ASTM Symp., Atlantic City, 1 Jul. 1960 (See N70-28376 14-19)
Avail: SOD $5.50

A discussion on the background philosophy and definitions of the terms is presented. Precision is defined as a multiple of the standard deviation, and the accuracy should connote the idea of the error of individual measurements when that error is compounded of bias or systematic error and random or nonsystematic error. The measurement process, reference level, statistical resolution, and measures of precision and accuracy are also considered. N.E.N.

N70-28410# National Bureau of Standards, Washington, D.C.
QUALITY OF OBSERVATIONS: HOW TO EVALUATE ACCURACY
W. J. Youden *In its* Precision Meas. and Calibration, Vol. 1 Feb. 1969 p 361-364 Presented at 63d ASTM Symp., Atlantic City, 1 Jul. 1960 (See N70-28376 14-19)
Avail: SOD $5.50

The error in a measurement is broken down into (1) the systematic error inherent in the procedure, (2) the local systematic error of the laboratory using the procedure, and (3) the random error (precision). This breakdown should facilitate efforts to attain better accuracy. Several methods are given for identifying sources of error in measurements. Author

N70-28434 Princeton Univ., N.J.
ON THE PHYSICAL INFORMATION AVAILABLE FROM INTENSITY-CORRELATION EXPERIMENTS ON SINGLY SCATTERED LIGHT
Cyrus Duncan Cantrell, III (Ph.D. Thesis) 1968 366 p
Avail: Univ. Microfilms: HC $16.65/Microfilm $4.70 Order No. 69-10482

A theoretical study of what intensity correlation measurements on singly scattered light can reveal about a target in addition to what intensity measurements reveal. There are several different contributions to the intensity correlations of light scattered by a target which is large compared to the correlation length of the fluctuations responsible for the scattering. It is shown (classically and quantum-mechanically) that all the information about the target available from intensity correlation measurements is contained in a certain correlation function. The spatial and temporal behavior of this function can, in principle, be determined from intensity correlation experiments. An expression for the signal to noise ratio for intensity correlation measurements is derived, using the shot effect representation, and is evaluated for several examples. Finally, certain questions in quantum mechanical measurement theory which are relevant to the calculation of the intensity correlation are discussed. Dissert. Abstr.

N70-28464 Johns Hopkins Univ., Baltimore, Md.
RULED GRATING MEASUREMENT OF THE Al-K alpha DOUBLET WAVELENGTH
Albert Henins (Ph.D. Thesis) 1969 193 p
Avail: Univ. Microfilms: HC $8.80/Microfilm $3.00 Order No. 69-21093

An absolute wavelength measurement of the Aluminum K alpha 1,2 line was made by use of a plane grating of nearly ideal surface contour. The making of this type of grating required the development of new techniques. The spectrum produced by the grating was recorded on photographic plates. From measurements of the grating space of the grating, relative positions of the plates, and the positions of the spectral lines along the plates, the absolute wavelength of the unresolved Al K alpha 1,2 doublet was evaluated. The results obtained was 8.34034 + 0.00005 A. The wavelength of Al K alpha 1,2 was measured with respect to the CuK alpha 1 (a secondary standard lambda = 1.540562 A°). These data yield a conversion factor A° = 1.000006 A/A° + or - 6.4 ppm. Dissert. Abstr.

N70-28476 Maryland Univ., College Park.
AN EXPERIMENTAL STUDY OF THE SCATTERING OF LASER LIGHT FROM CARBON DIOXIDE NEAR THE LIQUID-GAS TRANSITION POINT
John Sigfred Osmundson (Ph.D. Thesis) 1968 263 p
Avail: Univ. Microfilms: HC $11.95/Microfilm $3.40 Order No. 69-20302

Light scattered at an angle of 11 deg with the forward direction was collected and analyzed by using a homodyne detection system. Data obtained with the experimental apparatus is presented and analyzed. The critical parameters gamma, beta, and delta were measured and the values are in agreement with predictions of scaling law analysis. Equations are given to define the critical constants. Dissert. Abstr.

N70-28559# Air Force Systems Command, Wright-Patterson AFB, Ohio.
PROBLEMS IN NONLINEAR OPTICS (SELECTED CHAPTERS)
S. A. Akhmanov et al 19 Dec. 1969 180 p refs Transl. into ENGLISH from the Russian
(AD-702140; FTD-MT-24-259-69) Avail: CFSTI CSCL 20/6

Contents: Bases of the theory of waves in a nonlinear dispersive medium; Parametric effects in optics; and Modulated waves in nonlinear dispersive media. TAB

N70-28616 Dartmouth Coll., Hanover, N.H.
WAVE PROPAGATION IN A TURBULENT MEDIUM
Steven Francis Clifford (Ph.D. Thesis) 1969 88 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 69-21227

Line-of sight wave propagation in non-ionized turbulent media is discussed. The spectra for amplitude and and phase fluctuations are calculated by applying a perturbation technique to the three-dimensional wave equation. The spectra are found under less restrictive wavelength limitations such that these results are valid for frequencies lower than in previous work. Acoustic and electromagnetic waves in the atmosphere and acoustic waves in the ocean are considered. It is shown in all three cases that the results derived under the assumption that the wavelength is much smaller than the inner scale of turbulence, l sub o, are also valid when the wavelength is equal to or greater than l sub o. Formulas are presented which may be used to check the range validity of this result, and in those cases where the short wavelength formulas are not valid, the spectra for the long wavelength case are given. Dissert. Abstr.

N70-28818*# Illinois Univ., Urbana. Antenna Lab.
REMOTE PROBING OF INHOMOGENEOUS MEDIA USING PARAMETER OPTIMIZATION TECHNIQUES
M. Mostafavi and R. Mittra Apr. 1970 56 p refs
(Grant NGR-14-005-009)
(NASA-CR-110015; UILU-Eng-70-301; SR-14; Rept-70-6) Avail: CFSTI CSCL 20C

The problem of remote probing and diagnostics of an inhomogeneous medium whose properties vary along a single dimension only are discussed. The medium is described in terms of a set of unknown parameters that are determined via parameter optimization techniques. These techniques adjust the trial parameters describing the medium such that the response of the trial medium agrees closely with that of the actual medium. Author

N70-28912# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Festkoerper- und Neutronenphysik.
FERROELASTICITY NEAR THE CRITICAL POINT FOR HYDROGEN AS LATTICE GAS IN NIOBIUM [FERROELASTIZITAET IM BEREICH DES KRITISCHEN PUNKTES FUER WASSERSTOFF ALS GITTERGAS IN NIOB]
Joachim Tretkowski Dec. 1969 52 p refs In GERMAN
(JUL-826-FN) Avail: CFSTI

The elastic susceptibility near the critical point of hydrogen in niobium was measured. Reversible elastic aftereffects up to 900% were observed, which are three orders of magnitude higher than the known ones. Above the critical temperature the elastic susceptibility obeys a Curie-Weiss law. It is shown that theoretically the elastic susceptibility is proportional to the hydrogen density, and the square of the dipole moment tensor is thus analogous to the magnetic susceptibility. This agreement of the elastic and magnetic phenomena justifies giving the term ferroelasticity to the large aftereffect. ESRO

N70-28929# Brookhaven National Lab., Upton, N.Y. Accelerator Dept.
CORRECTION OF THE ORBIT IN A SECTION OF THE AGS RING
U. Vogel 23 Dec. 1969 17 p refs
(BNL-14330) Avail: CFSTI

The application of a computational method for derivation of orbit perturbations from pickup electrode readings for automatic control of the AGS ring magnet positions is described. The magnet derivations within a given section of the ring are considered, and the orbit is compensated to follow the magnet centerline closely and indicate zero readings in the pickup electrodes. NSA

N70-28947# Saclant ASW Research Center, La Spezia (Italy).
COHERENT REFLECTION BY THE ROUGH SEA SURFACE OF THE ACOUSTIC FIELD FROM A SOURCE OF ARBITRARY DIRECTIVITY
Richard H. Clarke 15 Apr. 1970 28 p refs
(TM-152) Avail: CFSTI

The angular plane-wave spectrum representation of the acoustic field due to a source of arbitrary directivity is used to formulate the problem of scattering by a rough sea surface. An approximate solution is obtained by applying a Kirchhoff-type boundary condition at the surface. The solution suggests a straightforward modification of current ray-tracing techniques in order to estimate the coherent part of the reflected field. Author (ESRO)

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N70-27811# Naval Research Lab., Washington, D.C. Nuclear Physics Div.
DATA ANALYSIS FOR ELECTRON-NUCLEAR DIFFERENTIAL SCATTERING CROSS SECTIONS
L. W. Fagg and W. L. Bendel Dec. 1969 29 p refs
(AD-702392; NRL-MR-2085) Avail: CFSTI CSCL 20/8

A method is described which converts electron scattering data, obtained as the ratio of detector system counts to integrated beam current, into absolute differential cross sections. The method utilizes the characteristics of the apparatus, of the electron scattering process, and of the energy loss in the target. Author (TAB)

N70-27864# Aerospace Corp., El Segundo, Calif. Space Physics Lab.
THICK-TARGET BREMSSTRAHLUNG FROM ELECTRONS WITH AN ENERGY SPECTRUM AND AN ANGULAR DISTRIBUTION Technical Report, Oct. 1968 - Jun. 1969
Gilberto Ialongo 30 Dec. 1969 45 p refs
(Contract F04701-69-C-0066)
(AD-701380; TR-0066(5260-20)-2; SAMSO-TR-70-32) Avail: CFSTI CSCL 20/8

A formula for the bremsstrahlung radiation cross section from thick targets has been derived for monoenergetic electrons impinging normally on the absorber and has been extended to the case where electrons are allowed to have an energy spectrum and an angular distribution. The basic theory makes use of the Bethe-Heitler formula for thin targets and includes corrections for the absorption and buildup of photons, electron penetration in the target including multiple electron scattering, electron backscattering out of the target, electron energy loss in the target, and electron - electron bremsstrahlung. Author (TAB)

N70-27893# Academia R. P. R., Bucharest. Inst. de Fizica Atomica.
ON THE POSSIBILITY OF NEW EXPERIMENTS AT LOW ENERGY
I. Boca 1969 11 p refs In FRENCH
(IFA-CRD-39) Avail: AEC Depository Libraries

The angular distributions, differential cross sections, polarizations, triple scattering parameters R and A, the spin rotation angle were calculated for the elastic scattering of protons at 4.5 MeV on carbon using the phase shift analysis. An attempt was made to give a small variation in the phase shifts, and the effect of this variation was studied. For good phase shift accuracy, it is proposed to carry out new experimental determinations at low energy in regard to the Wolfenstein paramaters R and A using a polarized proton source. Author (NSA)

N70-27911# Stanford Linear Accelerator Center, Calif.
FILMPLANE RECONSTRUCTION OF TRAJECTORIES IN A NONUNIFORM MAGNETIC FIELD: THE COMPUTER PROGRAM SYBIL
Dietrich E. C. Fries Dec. 1969 36 p refs
(Contract AT(04-3)-515)
(SLAC-103) Avail: CFSTI

The computer program SYBIL for analysis of streamer chamber pictures at SLAC is described. The program is designed to compute spatial track coordinates from film measurements by least square optimization of the geometrical parameters directly in the three film planes. NSA

N70-27938# Oak Ridge National Lab., Tenn.
MEASUREMENT AND CALCULATION OF DOSE RATE REMOVAL CROSS-SECTIONS AND B-FACTORS OF NEUTRONS
E. Kolb et al [1969] 7 p refs Transl. into ENGLISH from Acta Phys. Austr., v. 29, 1969 p 160 - 165
(ORNL-TR-2247) Avail: CFSTI

The apparatus for the measurement of the dose rate removal cross section and the buildup factors with a Pu - Be source is sketched. The attenuating effect of water, oil, and paraffin was measured as a function of the thickness of layer up to 45 cm. The

transmission factor was plotted as a function of the thickness of layer on a semilogarithmic coordinate system. The values of the buildup factors for the materials investigated are plotted as a function of the thickness of the absorbing layer. The values of the removal cross sections for the dose rate equivalent are tabulated.
NSA

N70-27942*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RADIATION PHYSICS RESEARCH AT MARSHALL SPACE FLIGHT CENTER: RESEARCH ACHIEVEMENTS REVIEW, VOLUME 3, MARCH 1968 - FEBRUARY 1970
1969 99 p refs
(NASA-TM-X-53845; Rapt-7) Avail: CFSTI CSCL 20H

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N70-27943*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A SUMMARY OF RESEARCH IN ELECTRON TRANSPORT AND BREMSSTRAHLUNG CROSS SECTIONS, RELATIVITY EXPERIMENTS, AND PLASMA SHIELDING
Nat Edmonson *In its* Radiation Phys. Res. at MSFC: Res. Achievements Rev., v. 3 1967 p 1 - 12 refs (See N70-27942 14-24)
Avail: CFSTI CSCL 20H

Basic research in electron transport and bremsstrahlung cross sections was motivated by the need for more precise knowledge about the interaction of electrons and other charged particles with materials used in space research programs. The results obtained from experimental studies of electron transmission and bremsstrhalung production are reported. The purpose of the studies was to measure secondary electron spectra, bremsstrahlung spectra, and cross sections for electron interactions in the primary energy range of 1 to 10 MeV. Two additional studies are described involving relativity experiments and a study of plasma shielding against space radiation.
Author

N70-27955# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics.
INVESTIGATION OF THE PROTON ANGULAR DISTRIBUTIONS FROM THE REACTION C-12(H-3,p)N-14
G. Schirmer, M. I. Krivopustov, H. Oehler, and I. V. Sizov 1969 19 p refs In RUSSIAN
(JINR-P-15-4801) Avail: AEC Depository Libraries

Detailed measurements of the angular distributions of three groups of protons from the reaction studied, which lead to the formation of the residual nucleus N-14 in the ground and two first excited states, were performed using an electrostatic generator accelerating He-3 in the energy range 2.2 to 3.6 MeV.
Author (NSA)

N70-27969# Oak Ridge National Lab., Tenn.
ENERGY DISTRIBUTION OF PHOTONEUTRONS PRODUCED BY 150 MeV ELECTRONS IN THICK Be AND Ta TARGETS
R. G. Alsmiller, Jr., T. A. Gabriel, and M. P. Guthrie 11 Sep. 1969 27 p refs
(ORNL-TM-2751) Avail: CFSTI

Electron-photon cascade calculations and photoneutron-production calculations have been carried out for 150-MeV electrons on thick targets of Be and Ta. The calculated neutron-production spectra cover the energy range 0.01 MeV to approximately 100 MeV. Results on the photoproton-production spectra are also given.
Author (NSA)

N70-27970# Oak Ridge National Lab., Tenn.
CARBON NEUTRON ELASTIC AND INELASTIC SCATTERING CROSS SECTIONS FROM 4.5 TO 8.5 MeV
F. G. Perey and W. E. Kinney Dec. 1969 69 p refs
(Contract W-7405-eng-26)
(ORNL-4441) Avail: CFSTI

Numerical values are given for neutron elastic- and inelastic-scattering cross sections from carbon in the energy range 4.5 to 8.5 MeV. A brief description of the experimental and data-reducing techniques is presented to assist in the evaluation of the data. A comparison was made with other data in this energy region, and fairly good agreement was found, particularly with previous time-of-flight data. The data were also compared with the predictions obtained from the current ENDF/B file of evaluated cross sections for carbon. The ENDF/B file was found to reproduce very poorly the data for both elastic and inelastic cross sections. This is not too surprising in view of the rapid changes in the shapes of the cross sections and the paucity of data previously available in this energy region.
Author (NSA)

N70-27974# Oak Ridge National Lab., Tenn.
SHIELDING BENCHMARK PROBLEMS
A. E. Profio, ed. Jun. 1969 109 p refs
(Contract W-7405-eng-26)
(ORNL-RSIC-25; ANS-SD-9) Avail: CFSTI

Several benchmark problems for testing computational methods of radiation transport are discussed. The first four problems are described and solution data are presented. These problems are: fast neutron spectrum from a point fission source in infinite graphite, gamma ray spectrum from a point Cs-137 source in infinite water, neutron spectrum from point fission and 14-MeV sources in infinite air, and gamma ray dose above a plane source of Co-60 on an air/ground interface.
NSA

N70-27998*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DAISEY: AN EFFICIENT PROGRAM FOR PRODUCTION OF NEUTRON PSEUDO RESONANCE PARAMETER CHAINS IN THE UNRESOLVED ENERGY REGION
Thor T. Semler Washington May 1970 43 p refs
(NASA-TN-D-5837; E-5378) Avail: CFSTI CSCL 20H

A computer program for efficiently generating neutron pseudo resonance parameter chains is presented. The code DAISY makes use of the central limit theorem to select chains that reproduce average cross section values. The code uses both the chi square and Kolmogorov-Smirnov tests for goodness of fit to produce chains of resonance parameters with the Porter-Thomas and Wigner distribution functions. As an example, the code is used to generate U-238 cross sections in the unresolved resonance region near 20 keV. These continuous cross sections are used to calculate the Doppler effect, and to estimate the s-wave, p-wave overlap effect at 20 keV. The computed Doppler coefficient for U-238 at 20 keV is consistent with other theoretical calculations for both a thin foil and a thick sphere.
Author

N70-28012# Syracuse Univ., N.Y. Dept. of Physics.
REGGE-POLE EIKONAL THEORY OF SMALL-ANGLE K(0)-NUCLEON SCATTERING

Maurice L. Blackmon Dec. 1969 11 p refs Supported by AEC Prepared jointly with Tufts Univ., Medford, Mass.
(SU-1206-218; NYO-3399-218) Avail: CFSTI

A Regge-pole model with absorptive corrections is used to calculate the differential cross sections and polarizations for the reactions K(0) sub 2 p yields K(0) sub 1 p and K(0) sub 2 p yields K(0) sub 2 p. Author (NSA)

N70-28062# Virginia Univ., Charlottesville. Div. of Nuclear Engineering.
TRANSLATION TO ENDF/B AND PHYSICS CHECKING OF CROSS SECTIONS FOR SHIELDING Final Report, 1 Feb.–31 Oct. 1969
Donald J. Dudziak Nov. 1969 98 p refs
(Contract DASA01-69-C-0029)
(AD-702128; NE-3383-104-69U; DASA-2379) Avail: CFSTI CSCL 20/8

Evaluations of neutron interaction and photon production cross sections for sodium, magnesium, chlorine, potassium, and calcium have been translated from a modified-UK format into ENDF/B format. The data have been reviewed and revised to a minor extent, and can be used by the LAPH code to generate multigroup photon production cross section matrices. Several physics checks have been proposed for the photon data, and a FORTRAN IV code, PHOX, has been written to incorporate some of these checks. TAB

N70-28083*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE MARGENAU APPROXIMATIONS TO THREE- AND FOUR-CENTER MOLECULAR INTEGRALS
David L. Morgan, Jr. May 1970 40 p refs Submitted for publication
(NASA-TM-X-63920; X-641-70-175) Avail: CFSTI CSCL 20H

Because of the complexity of most three- and four-center integrals that arise in the variational treatment of molecular structure, approximations are used in their evaluation. The Margenau approximations are shown to have good accuracy when the distance, R, between the charge distributions involved in the integrals is large compared to the spatial size of the distributions. Comparisons of values given by these approximations with accurate values of some relatively simple three- and four-center integrals confirm this fact. Comparisons with the Sklar and Mulliken approximations indicate that Margenau's second approximation is more accurate than those latter approximations in nearly all cases similar to those considered when R is at least five times the radial size of the atomic orbitals upon which the molecular wave functions are based. This form of the multipole expansion for the integrals is used to predict and interpret the relative accuracies of the approximations in terms of the inclusion or neglect of the effects of higher multipoles and overlapping of the charge distributions. A proposed combination of Margenau's two approximations is considered to be superior to both in most cases. Author

N70-28113*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPIN POLARIZATION IN THE ELECTRON GAS BY A MAGNETIC IMPURITY: THEORY OF THE EXCESS KNIGHT SHIFT
Burke Ritchie Apr. 1970 23 p refs Submitted for publication
(NASA-CR-63896; X-641-70-117) Avail: CFSTI CSCL 20H

A two center analog of a virtual process is described which is responsible for most of the Fermi contact hyperfine structure of open shell atoms (polarization of the closed s core). The first order energy due to the Fermi contact interaction of the conduction electrons at the Cu nucleus which have first exchange scattered from the 3d electrons of Mn is calculated as a function of R. It is found to change sign between R = 4.8299 (nearest neighbor distance), R = 4.8299 and R = 8, and R = 8 and R = 10 au, suggesting dependence on impurity concentration and compression or expansion which can change the lattice distances. The exchange potential is presented as a function of electron velocity and R. For completeness the RKKY type spin density waves are presented as a function of the distance from the impurity for several values of R. Also for R = 0 an estimate is made of the exchange polarization potential due to the adiabatic polarization of the impurity by the scattering electrons and found to be significant. Author

N70-28139# Mathematical Applications Group, Inc., White Plains, N. Y.
ANTE 2: A FORTRAN COMPUTER CODE FOR THE SOLUTION OF THE ADJOINT NEUTRON TRANSPORT EQUATION BY THE MONTE CARLO TECHNIQUE Final Report
M. O. Cohen Jan. 1970 162 p refs
(Contract DASA01-68-C-0115)
(AD-700920; MR-6910; DASA-2398) Avail: CFSTI CSCL 18/11

ANTE 2 is a FORTRAN code designed to solve the time-dependent neutron transport equation in a three-dimensional geometry by the adjoint Monte Carlo technique. In addition to theoretical discussions, a complete description of computer input and output is presented. Also provided is a description of two test problems and comparison with the results of other codes. ANTE 2 is written in FORTRAN IV and is presently operational on a CDC-6600 digital computer. Author (TAB)

N70-28160*# Gulf General Atomic, San Diego, Calif.
ELECTRON SHIELDING STUDIES: EXPERIMENTAL PROGRAM Technical Summary Report, 1 Aug. 1968–31 Dec. 1969
D. G. Costello, H. Weber and J. A. Lonergan 23 Jan. 1970 118 p refs
(Contract NAS8-11304; GA Proj. 447-1000)
(NASA-CR-102661; GA-9907) Avail: CFSTI CSCL 18F

The energy spectra of electrons transmitted through slabs of tin were measured as a function of angle with respect to the incident beam. The measured results are compared with calculations generated by the ETRAN 15 Monte Carlo program. (1) In addition, a formula has been empirically derived from the data obtained during this experimental program which gives the energy and angular distributions for electrons emerging from a slab of material as a function of incident electron energy. Absolute bremsstrahlung energy spectra have been measured as a function of angle from targets of tin of sufficient thickness for the electrons to lose all or a large fraction of their energy in the material. Incident electrons of 4.0 and 8.0 MeV were directed normal to the target. The results of these measurements are compared to ETRAN 15 calculations, as well as to the calculations of Dickinson and Lant. (2) Bremsstrahlung yield measurements have also been made on thin targets of silver and gold; these measurements are compared with those predicted from various bremsstrahlung cross section formulae. Author

N70-28199 Cornell Univ., Ithaca, N.Y.
DEVELOPMENT OF THE L X-RAY INTENSITY PATTERN METHOD FOR MULTIPOLARITY DETERMINATION AND ITS APPLICATION TO TANTALUM-182
Walter Frank Stabenau (Ph.D. Thesis) 1969 79 p
Avail: Univ. Microfilms. HC $4.20/Microfilm $3.00 Order No. 69-20998

A method was developed for determining the multipolarity and energy of low energy, highly converted nuclear transitions. For transitions below the K shell binding energy, only relative intensities of the L X-rays resulting from the transition need be observed, and difficulties associated with L and M conversion electron intensity measurements thereby avoided. The method was applied to investigate the 0.3-sec isomer in tantalum. Comparison of experimental and calculated values indicate only an E1 or an M2 transition multipolarity was possible for the isomeric transition. Calculations of L X-ray intensities and corresponding unconverted

gamma ray intensities indicate that a gamma ray should have been easily observable for an E1 multipole. Hence, the transition multipolarity could only be M2. A rough determination of the cross section for the 283-msec isomer of approximately seven barns compares favorably with the cross sections calculated by the statistical theory of Huizenga and Vandenbosh, thus giving added strength to the new level assignments. Dissert. Abstr.

N70-28200 South Carolina Univ., Columbia.
THE A-40(He-3,d)K-41 REACTION AT 10 MeV
William Fleet Lankford (Ph.D. Thesis) 1969 89 p
Avail: Univ. Microfilms HC $4.60/Microfilm $3.00 Order No. 69-20110

The Oak Ridge National Laboratory 5 MeV Van de Graaff accelerator was used to bombard an argon 40 gaseous target with 10 MeV doubly charged He-3 ions. Deuteron spectra were obtained at angles from 13 deg to 160 deg and the absolute differential cross sections determined. The theoretical basis for the A-40(He-3,d)K-41 reaction is discussed in terms of a semi-classical approach and the predictions for the ground state transition are indicated. The reaction mechanism is discussed with respect to both the compound nucleus formation and to the direct reaction process. Arguments for the dominance of the direct reaction are offered and the prediction that the reaction occurred primarily on the nuclear surface is substantiated. The real and complex optical potentials used in the distorted wave analysis are discussed and the parameters employed are given. The analytical treatment of the distorted wave theory is developed in the appendix. Dissert. Abstr.

N70-28205# Edgerton, Germeshausen and Grier, Inc., Las Vegas, Nev.
MEASURED LOW-ALTITUDE NEUTRON AND GAMMA DOSE DISTRIBUTIONS DUE TO A 14-MeV NEUTRON SOURCE
A. E. Fritzsche, N. E. Lorimier, and Z. G. Burson 21 Aug. 1969 67 p refs Sponsored by AEC
(EGG-1183-1449; L-955) Avail: CFSTI

Neutron and gamma dose distributions due to a 14-MeV neutron source were measured for many source detector geometries in a large vertical plane above the ground air interface. The purpose of the measurements was to describe the neutron and gamma tissue dose distributions as a function of source height, detector height, and slant range. The doses were obtained at a 3-ft detector height for 27-through 1125-ft source heights. Dose measurements at other detector heights were more limited in extent. Principal characteristics of the dose distributions found were: (1) The ground appears to reflect neutrons (increase the dose) close to the source and absorb them far from the source. This is similar to the behavior for a fission neutron source. (2) The dose near the ground at a given slant range increases appreciably as the source is raised above the ground. (3) The ground reflection and absorption effect (ground perturbation) increases as the detector approaches the ground. (4) The ground produces more gammas than the air it displaces. Author

N70-28206 State Univ. of New York at Buffalo.
SUM RULES FOR THE d(gamma,n)p PROCESS EMPLOYING REALISTIC POTENTIALS, PART 1. APPLICATIONS OF THE INTERMEDIATE-COUPLING UNIFIED NUCLEAR MODEL TO ODD-MASS IODINE AND LANTHANUM ISOTOPES, PART 2
Jerome George Lucas (Ph.D. Thesis) 1969 161 p
Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 69-20527

Realistic potentials are tested by studying the sum rules for the photodisintegration of the deuteron. The advantage of this approach is that one need only know the ground state of the nucleus under investigation. Integrated cross section, bremsstrahlung-weighted cross section, as well as the electric polarizability of the deuteron are calculated. The results are compared with deuteron photodisintegration experiments, by numerically integrating the total cross section curve vs. the energy of the incident gamma ray. The results indicate insensitivity to the potentials. Dissert. Abstr.

N70-28208 Washington Univ., Seattle.
NUCLEAR POLARIZATION AND SUBSTATE POPULATIONS OF THE FIRST EXCITED STATE IN CARBON-12 EXCITED IN INELASTIC ALPHA PARTICLE SCATTERING
Thomas Doyle Hayward (Ph.D. Thesis) 1969 227 p
Avail: Univ. Microfilms: HC $10.35/Microfilm $3.00 Order No. 69-20231

The normalized angular correlation function between inelastically scattered alpha particles and coplanar de-excitation gamma-rays is considered. An excitation function measured between 21.0 and 23.0 MeV clearly indicates resonant structures in the O-16 compound system at bombarding energies of 21.28, 21.9, and 22.32 MeV. The correlation measurements show that at this energy the C-12 recoil nuclei are strongly polarized at many scattering angles, and that the sign of this polarization can only change at two angles within the range of investigation. Subsequent measurements of the sense of circular polarization of the de-excitation gamma rays were made using a magnetized cylindrical iron polarimeter. The measurements indicate that for scattering angles between 20 deg and 70 deg the m = 2 substate predominates, whereas at the more backward angles, 80 deg to 170 deg, the m = +2 substate predominates. The forward angle data is consistent with the classical picture of scattering from a repulsive potential while the equivalent interpretation at back angles is that of scattering from an attractive potential. Dissert. Abstr.

N70-28209# General Electric Co., Schenectady, N.Y. Knolls Atomic Power Lab.
IMPROVED THEORETICAL CROSS SECTION FOR POLYETHYLENE
G. J. Kirouac, S. K. Jernow, W. E. Moore, and L. J. Esch 18 Nov. 1969 9 p Presented at 17th Conf. on Remote Systems Tech., San Francisco; sponsored by Am. Nucl. Soc.
(Contract W-31-109-eng-52)
(KAPL-P-3860; Conf-691102-8) Avail: CFSTI

The thermal neutron cross section of polyethylene is studied to improve the existing treatments and orientation averaging schemes. Starting with the usual description of incoherent scattering in the Gaussian approximation, it is shown that only two polarization vectors, one longitudinal and one transverse exist. Neutron multiple scattering for polyethylene is graphed. F.O.S.

N70-28226 Clemson Univ., S.C.
ELASTIC AND INELASTIC NUCLEON SCATTERING
John Thaddeus Rompala (Ph.D. Thesis) 1969 61 p
Avail: Univ. Microfilms: HC $3.60/Microfilm $3.00 Order No. 69-19739

The in-state of the system is first written using the notation of second quantization. A transition is made to the in-state wave function. A spectral representation of the Green function operator is then formulated. This is achieved using a single particle model Hamiltonian with the complete orthonormal set of its eigenfunctions. These eigenfunctions are antisymmetrized. The resulting set is, however, nonorthogonal. A formal elimination of a subset of this nonorthogonal set allows the construction of a spectral representation which refers to elastic and inelastic channels only. The T matrix for scattering into a given channel is expressed in terms of a projectile distorted wave state and the given target state. This matrix also permits a straight forward perturbation expansion in terms of a residual interaction and demonstrates explicitly exchange effects. Dissert. Abstr.

N70-28227 Arizona State Univ., Tempe.
GAMMA RAYS FROM THE PRIMARY FISSION FRAGMENTS OF CALIFORNIUM-252
Donald Ray Ruegsegger, Jr. (Ph.D. Thesis) 1969 100 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 69-20795

An experiment has been carried out to study the gamma rays from the primary fragments produced during the spontaneous fission of californium-252. The Z values of the fragments studied were determined by detecting their characteristic K alpha 1 X-rays with a lithium-drifted silicon X-ray spectrometer. A single channel analyzer was used to accept only pulses corresponding to the K alpha 1 X-rays of the element under study. The resolution of the X-ray pulses was 1.6 keV FWHM at an energy of 30.97 keV. The gamma rays were detected with a lithium-drifted germanium detector and were energy analyzed by a 1024 channel analyzer. A time coincidence system was used to accept only those gamma rays that occurred within 0.175 microsecond of the preselected X-ray. The resolution of the gamma ray system was around 8 keV FWHM at an energy of 276 keV. Dissert. Abstr.

N70-28228 Minnesota Univ., Minneapolis.
ELASTIC SCATTERING OF NEGATIVE PIONS FROM DEUTERONS AT 2.01, 3.77, AND 5.53 GeV/c
Terry Glenn Rhoades (Ph.D. Thesis) 1969 87 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 69-20051

Measurements were made of the differential cross section for elastically scattering negative pions from deuterons in the 4-momentum transfer squared region, at 2.01, 3.77, and 5.53 GeV/c. The results are compared to Glauber multiple scattering theory calculations. Elastic events were detected in a double-arm spectrometer consisting of two bending magnets and three scintillation counter arrays. Possible elastic deuteron events were encoded and stored in a multichannel analyzer. Multiple scattering theory is reviewed including spin effects, the deuteron D state, double charge exchange, and the high energy limit. The data is found to be in good agreement with the Glauber model and with lower energy phase shift analyses. The data does not support Regge pole dominance at these energies. Dissert. Abstr.

N70-28258 Minnesota Univ., Minneapolis.
INELASTIC SCATTERING OF 40-MeV-PROTONS BY Ni 58 AND Ni 60 AND COUPLED CHANNEL ANALYSIS
Nanjappa Lingappa (Ph.D. Thesis) 1969 115 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 69-20034

Data from the inelastic scattering of 40 Mev protons by Ni-58 and Ni-60 are presented and analysed in terms of a coupled channels approach. Previous discrepancies between the experimental and theoretical (2+) first excited state distributions are removed. The nature of coupled channel calculations at this energy are discussed, with reference to absorptive strengths and form factors; the (4+) states around 2.5 Mev excitation are shown to require one-phonon mixing in order to be able to explain the observed cross sections. Spin-parity assignments are given for states at 3.2 Mev, 5.1 Mev and 6.1 Mev excitation in Ni-60, which have not been studied before in proton inelastic scattering at this energy. Dissert. Abstr.

N70-28259 Baylor Univ., Waco, Tex.
ALPHA-PARTICLE STOPPING CROSS SECTION IN SOLIDS FROM 400 keV AND 2 MeV
Wie-Kan Chu (Ph.D. Thesis) 1969 152 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 69-21656

The experimental method consists of the elastic scattering of alpha particles from a thick Ta backing onto which a thin layer of target element has been evaporated. The energy loss of alpha particles in the target film is determined by the difference in energy of alpha particles scattered from clean Ta and from Ta after having gone through the thin layer of target element. The energy loss results are compared with earlier data with agreement from 1 to 20%. A decrease of the alpha-particle stopping cross section with the stopping-element atomic number Z2 is observed in the region Z2 = 22 to 29. Dissert. Abstr.

N70-28282# Central Research Inst. for Physics, Budapest (Hungary).
C VIOLATION IN ETA DECAY
A. Frenkel, G. Vesztergombi, and G. Marx 1969 20 p refs
(KFKI-22-1969 Avail: AEC Depository Libraries

The recent experimental results on the charge asymmetry in eta decay were compared with a theoretical model of C violation. Five asymmetry parameters of the energy distribution were defined and their measured values reproduced by the model within one standard deviation. The implication of the experimental upper limit on the decay was also taken into account. Order of magnitude estimates indicate that the model is not in contradiction with the experimental results on the decay. NSA

N70-28283# Central Research Inst. for Physics, Budapest (Hungary).
CHARGE-STATE OSCILLATIONS IN NEUTRON-PROTON SCATTERING
Gy. Hrehuss and T. Czibok 27 Mar. 1969 39 p refs
(KFKI-10/1969) Avail: AEC Depository Libraries

Periodic state-flipping phenomena analogous to those occurring at electromagnetic excitations were found for neutron-proton scattering. The periodic charge-state flipping manifests itself as an oscillation in the energy dependence of both the total cross section and the differential cross section at forward proton angles. The flipping frequency measured is in good agreement with that estimated theoretically making use of a simple model for charge-exchange processes. Author (NSA)

N70-28285# Akademiya Nauk Ukrainskoi SSR, Kiev. Inst. Teoreticheskoi Fiziki.
GROUP EMBEDDING THEORY AND STRONGLY INTERACTING PARTICLES
I. I. Kostyrko 1969 9 p ref In RUSSIAN Presented at the 3d Conf. on Axiomatical Field Theory and Theory of Elementary Particles, Kiev, USSR
(ITF-69-54; CONF-690417-21) Avail: AEC Depository Libraries

Recently, a theory of group embedding was applied in the case of nonrelativistic model of hydrogen atom with a view to the bound state spectrum. The above mentioned scheme of group embedding is applied for strongly interacting particles. There is found a symmetry group and a dynamic group for hadrons, the knowledge of which entirely solves the problem of the hadron mass spectrum. It is clear that the group SU(n) $\otimes$ SU(n) is a symmetry group for hadrons and the group SU(2n + 1) is a dynamical group. The obtained theoretical results are compared with experimental data. Author (NSA)

N70-28289 Stevens Inst. of Tech., Hoboken, N.J.
THE EFFECTS OF QUASIPARTICLE RENORMALIZATION IN THE NONIDEAL BOSE GAS
Anthony D. Novaco (Ph.D. Thesis) 1969 284 p
Avail: Univ. Microfilms: HC $12.85/Microfilm $3.65 Order No. 69-21298

The effects of quasiparticle interactions on the Bose-Einstein phase transition in the hard sphere Bose gas are investigated by means of a temperature dependent Hartree-Fock approximation in the quasiparticle dynamics. The resulting equations are solved in terms of a set of relevant functions which depend on both momentum and a number of parameters. These parameters are solely a function of the density and temperature, and they are

determined by momentum integrals which involve the relevant functions. A self-consistent determination of the parameters for various values of the density and temperature was made by numerically iterating the integral equations until stable values of the parameters were found. Dissert. Abstr.

N70-28270 Colorado Univ., Denver.
ANGULAR MOMENTUM, SHELL STRUCTURE, AND RELATIVISTIC EFFECTS IN AN IMPROVED MODEL OF THE ATOM
Melvyn Arnold Holzman (Ph.D. Thesis) 1969 190 p
Avail: Univ. Microfilms: HC $8.60/Microfilm $3.00 Order No. 69-19544

A comprehensive comparison of the statistical Thomas-Fermi model and the method of self-consistent fields (SCF) for atomic calculations indicates that an improved statistical model of the atom would greatly simplify applications which depend on the use of the statistical model. The numerical complexity of the SCF method makes it highly impractical for applications where a simple model is necessary in order not to add complications to the basic problem. The Green's function method in the Hartree-Fock approximation is utilized in order to incorporate aspects of the statistical theory into the framework of the SCF method. It is shown that the Thomas-Fermi model results from this formalism in a natural way when the Thomas-Fermi homogeneity approximation is made. The SCF equations result without any further approximations. The purpose of this research is to use this formalism to investigate the possibility of incorporating specific properties of the SCF equations into the statistical Thomas-Fermi model, with the objective of obtaining an improved statistical model of the atom. Dissert. Abstr.

N70-28281# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.
JOST FUNCTION FOR THE TWO CHANNEL SCATTERING PROBLEM
M. L. Kharakhan and Yu. M. Shirokov 1969 10 p refs In RUSSIAN Presented at the 3d Conf. on Axiomatical Field Theory and Theory of Elementary Particles, Kiev
(ITF-69-65; CONF-690417-20) Avail: AEC Depository Libraries

The generalization of the Jost function is introduced for the case of the two-channel scattering of nonrelativistic spinless particles under the arbitrary (not necessary local) interaction Hamiltonian. The problem of deriving the two-channel Jost matrix in terms of the physical S-matrix is reduced to the nonsingular integral equation for a single function. It is demonstrated that the explicit form for the Jost matrix is obtainable if the usual assumptions hold about the analytical properties of the S-matrix elements. Author (NSA)

N70-28282# California Univ., Livermore. Lawrence Radiation Lab.
COMPILATION OF X-RAY CROSS SECTIONS
W. H. McMaster, N. Kerr Del Grande, J. H. Mallett, and J. H. Hubbell Aug. 1969 194 p
(UCRL-50174) Avail: CFSTI

This section contains graphs and tables of X-ray sections used to obtain the cross section tables (cross sections in the range of 1 keV to 1 MeV). Author (NSA)

N70-28283# Oak Ridge National Lab., Tenn.
A COMPARISON OF FOLDING AND UNFOLDING TECHNIQUES FOR DETERMINING THE GAMMA SPECTRUM FROM THERMAL NEUTRON CAPTURE IN ALUMINUM
R. S. Booth 5 Mar. 1970 22 p refs
(AD-702667; ORNL-TM-2898) Avail: CFSTI CSCL 18/4

The gamma-ray spectrum above 1 MeV resulting from thermal-neutron capture in aluminum is determined by both a folding and an unfolding analysis of data. This results in a comparison of the relative merits of the two analysis techniques and demonstrates the accuracy that can be obtained in unfolding a complex spectrum. It is concluded that the accuracy of the final photon spectrum is not governed by the technique employed to unfold the measured counts. Author (TAB)

N70-28301 Colorado Univ., Boulder.
A STUDY OF ROTATIONAL STATES OF DY 158, ER 162, ER 164, YB 168, AND HF 174 EXCITED BY NEUTRON EVAPORATION REACTIONS
James Hubert Jett (Ph.D. Thesis) 1969 154 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 69-19547

The resulting prompt gamma ray spectra were analyzed with a curved crystal diffraction spectrometer and with lithium-drifted germanium detectors. The diffraction spectrometer, which was installed on-line with the cyclotron, was used to make energy measurements of the first four transitions in the ground state bands of all the nuclei except Er-162. Cross section and energy measurements for all the nuclei were made with Ge(Li) detectors. Transitions from levels in the ground state bands were observed. The gamma-vibrational bands in three of the nuclei were strongly excited and several beta-bands were weakly excited. The cross sections for transitions in the ground state band agree with the statistical model calculations made which are based on a charged completely absorbing model of the nucleus for calculation of the formation cross section and on statistical theory for calculation of the neutron evaporation. Within the validity of the calculations made, no angular momentum deficit was observed, i.e., there is no difference between the observed angular momentum distribution and model predictions. Dissert. Abstr.

N70-28302 Minnesota Univ., Duluth.
THE EFFECT OF NUCLEAR SHELL-MODEL CONTINUUM STATES ON FORM FACTORS FOR PARTICLE TRANSFER REACTIONS
Rufino Herrera Ibarra (Ph.D. Thesis) 1969 87 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 69-20022

A theory is developed for the proper treatment of the continuum-continuum interaction in the shell-model Hamiltonian which uses a finite range single particle potential. The continuum contributions are treated by an extension of the diagonalization methods in the ordinary shell-model analysis. The method is then applied to the calculation of form factors for one particle and two-particle transfer reactions on Ca-42 and compared with the methods of other workers. Correlations introduced by mixing continuum states with the discrete configurations ensure the correct normalization and asymptotic dependence in the form factor. It is found that the continuum contributions have a little effect on the calculated energies but have a large effect on their radial wave functions and therefore a significant effect on the results of particle transfer reactions. Dissert. Abstr.

N70-28305# Naval Postgraduate School, Monterey, Calif.
REACTION RATES FOR COLLISIONAL DE-EXCITATION OF THE B DOUBLET SIGMA (u) (T) STATE OF N2(T) OF THE C TRIPLET pi(u) STATE OF N2
Allan Ray Smelley (M. S. Thesis) Jun. 1969 39 p refs
(AD-701670) Avail: CFSTI CSCL 7/4

Pure nitrogen and nitrogen-oxygen gas mixtures at pressures from 1 to 800 torr and 300 K were excited by 1.5 MeV protons. Intensity versus pressure data were recorded and plotted for the first negative (B doublet sigma(u)(+) to x doublet Sigma(g)(+)) transition (3914.4A), and second positive (C pi(u) to B triplet pi(g)) transition (3371.3A) in nitrogen. Theoretical equations were derived for the intensity as a function of pressure, which were shown to agree quite well with the experimental data. The following

reaction rates, k, and de-excitation cross sections, sigma, were obtained from the derived theoretical equations and the experimental data.
Author (TAB)

N70-28306# Michigan State Univ., East Lansing.
THE OPTICAL POTENTIAL IN PROTON-NUCLEUS SCATTERING
Donald A. Slanina (Ph.D. Thesis) 1969 79 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 69-20934

The optical potential for 40 MeV protons is calculated for the spin zero nuclei of C-12, Ca-40, Ni-58, Sn-120, and Pb-208. The real central part of the potential is calculated to first order in the nucleon-nucleon effective interaction which is taken to be the G-matrix used in studies of the bound state properties of finite nuclei. The impulse approximation is used for an estimate of the spin orbit potential. The imaginary part of the optical potential is calculated from a perturbation treatment of the channels open for inelastic scattering. The energy dependence, isobaric dependence, effect of possible proton-neutron density differences, and antisymmetrization effects are considered for the real part of the central potential. Cross sections are calculated for the scattering of 20 and 40 MeV protons on C-12 and Ca-40 using the theoretical optical potential and compared to cross sections obtained from empirical optical potentials.
Dissert. Abstr.

N70-28312# Instituto de Energia Atomica, Sao Paulo (Brazil). Divisao de Radioquimica.
PRODUCTION OF RADIOISOTOPES IN THE DIVISION OF RADIOCHEMISTRY OF THE ATOMIC ENERGY INSTITUTE [PRODUCAO DE RADIOISOTOPOS NA DIVISAO DE RADIOQUIMICA DO INSTITUTO DE ENERGIA ATOMICA]
Goncalves da Silva and Constancia Pagano Jun. 1968 21 p refs In PORTUGUESE; ENGLISH summary Presented at the 2d Inter-Am. Conf. on Radiochem., Mexico City, 22 - 25 Apr. 1968 (IEA-159; CONF-680423-4) Avail: AEC Depository Libraries

Development of research relative to the present stage of production of radioelements is discussed. Some time considerations show the reasons for the selection of the isotopes presently produced and distributed. The characteristics of the material distributed, as for example, the degree of purity were discussed.
Author (NSA)

N70-28321# Los Alamos Scientific Lab., N. Mex.
FLUORESCENCE EFFICIENCIES OF NITROGEN BY 1- TO 5-MeV POSITIVE IONS
Jerry L. Dunn and Redus F. Holland 22 Dec. 1969 11 p refs (Contract W-7405-eng-36)
(LA-4314) Avail: CFSTI

Typically, a pressure of 3.6 torr was necessary to stop a beam of 4 MeV $N(+)$ ions in the 150-cm-long collision chamber. Power output in the 3914 A (0,0) band of the $N_2(+)$ first negative system was measured with an interference-filter photometer, and efficiencies for production of this band at lower pressure were calculated from the collisional deactivation rate. $N_2(+)$ first negative bands and N first positive and second positive bands were prominent in the spectra. Nearly all the first negative emission originated in the $v' = 0$ upper vibrational state. Most of the second positive emission was in the $v' = 0$ to 2 band sequences. Spectral intensities were corrected for effects of collisional quenching, to obtain low-pressure relative efficiencies. After corrections for collision quenching, the spectral distribution of nitrogen fluorescence excited by ions is similar to that in spectra obtained by Hartman for excitation of air by 850 eV electrons. Ratios of efficiencies of the N first positive bands to 3914 A efficiencies are not very different from ratios obtained by Mitchell for excitation of N by kilovolt X-rays.
Author (NSA)

N70-28331# Central Electricity Generating Board, Berkeley (England). Berkeley Nuclear Labs.
COALESCENCE OF DISLOCATION LOOPS BY SELF CLIMB
J. A. Turnbull Nov. 1969 19 p refs
(RD/B/N-1450) Avail: CFSTI

During an isothermal anneal of an ion bombarded UO_2 thin foil, electron microscope observations were made of the self climb velocity of dislocation loops prior to coalescence. A model for loop movement by self climb was constructed and two driving forces were considered. First, the mutual interaction of the loop strain fields, and second, the interaction between loops and individual vacancies. In the case of UO_2 the former predominates, but for metals both interactions are of similar magnitude. The model predicts that the loops remain circular during the climb process and that the velocity is rate controlled by the pipe diffusion coefficient at any particular temperature.
Author (NSA)

N70-28371# Daresbury Nuclear Physics Lab. (England).
RADIOACTIVITY INDUCED BY HIGH-ENERGY ELECTRONS
G. Saxon Apr. 1969 11 p refs Presented at the Conf. on Radiation Protection in Accelerator Environments, Chilton, England (DNPL/P-8, CONF-690320-2) Avail: AEC Depository Libraries

Reference is made to induced radioactivity problems consequent to the operation of the NINA 5-GeV electron synchrotron at Daresbury. All modes of operation lead to activation of machine parts to a greater or lesser extent. The principal activities are caused by photonuclear reactions, arising from photons in the showers produced when high energy electrons or photons strike a material. Since there was some doubt about the validity of the equation used for track length at energies in the region of the giant resonance, an alternative approach was adopted, using Monte Carlo calculations of the numbers of photons in a shower as a function of material depth. Activation was assessed in stainless steel, iron and copper.
NSA

N70-28388# National Bureau of Standards, Washington, D.C.
COMPARISON OF FOUR NATIONAL RADIUM STANDARDS PART 1: EXPERIMENTAL PROCEDURES AND RESULTS. PART 2: STATISTICAL PROCEDURES AND SURVEY
W. S. Connor and W. J. Youden *In its* Precision Meas. and Calibration, Vol. I Feb. 1969 p 108-116 refs *In its* Res. Paper 2544 (See N70-28376 14-19)
Avail: SOD $5.50

The two United States primary radium standards were compared with the British primary radium standard and the Canadian national radium standard (1) by an ionization method, using the NBS standard electroscope, (2) calorimetrically, using the Peltier-cooling radiation balance, (3) by means of a Geiger-Muller counter, and (4) using a scintillation counter. Where there is little or no difference in gamma ray source self absorption, the four methods give good agreement. In the case of the Canadian standard the difference in the results obtained is an indication of a difference in source self absorption. The statistical analysis of the observations and the adjustment of the readings are discussed. The adjusted values of the standards satisfy a consistency criterion. The adjusted values were improved by making the use of the proportional relationship between the masses and the radioactive effects of the standards.
Author

N70-28422# Princeton Univ., N.J. Palmer Physical Lab.
AN EXPERIMENTAL TEST OF CHARGE INDEPENDENCE IN $n + p$ YIELDS $d + \pi^0$(O)
D. F. Bartlett, C. E. Friedberg, K. Goulianos, I. S. Hammerman, and D. P. Hutchinson (Princeton-Pennsylvania Accelerator) [1969] 45 p refs
(Contracts AT(30-1)-2137; N0014-67-A-0151-0001)
(PURC-2137-17) Avail: CFSTI

The differential and total cross sections for the reaction neutron plus proton yields deuteron plus neutral pion were measured for neutron kinetic energies between threshold (275 MeV) and 700 MeV. Results are presented based on 90,000 events. A comparison

is made with existing data for proton plus proton yields deuteron plus positive pion to test the prediction of charge independence, deuteron, alpha(neutron, proton yields deuteron, neutral pion) = 1/2 deuteron,alpha) (proton, proton yields deuteron, positive pion) at the same cm energy and angle. No evidence for a violation is seen. Limits of a few percent are placed on the real part of certain amplitudes for I-spin nonconserving transitions from a study of the symmetry of the angle distributions about theta(*) = 90 deg.
Author (NSA)

N70-28423 Colorado Univ., Boulder.
THREE PION PRODUCTION PROCESSES IN 6.7 GeV/c PION(-) PROTON INTERACTIONS
Shigeyuki Miyashita (Ph.D. Thesis) 1969 260 p
Avail: Univ. Microfilms: HC $11.70/Microfilm $3.35 Order No. 69-19560

The complexity of these reactions is largely reduced by resonance productions in the intermediate states. In studying the invariant mass distributions, phase space is found to be a good first approximation to account for the shape of the distributions. For well-established resonances, resonance parameters (mass and width) thus obtained, are consistent with accepted values. Many higher boson resonances and nucleon isobars are found to be associated closely to the lower resonance states. The cross sections of higher excited states decaying directly into stable hadrons are estimated to be very small. Due to the high multiplicity of pions produced in the intermediate states, several competing channels must be taken into account for the model calculations.
Dissert. Abstr.

N70-28425# Scientific Translation Service, Ann Arbor, Mich.
PRODUCTION OF NEGATIVE PARTICLES BY PROTONS WITH ENERGIES OF UP TO 70 GeV
Yu. B. Bushnin et al [1969] 13 p refs Transl. into ENGLISH from the Russian Transl. for Oak Ridge Natl. Lab.
(ORNL-TR-2266; IFVE-SEF-69-18) Avail: CFSTI

The first experimental results are presented for forward angle production (< 15 mRad) of negative pion, negative K meson, negative rho meson by protons with energies up to 70 GeV. The target material was aluminum and the secondary momenta investigated were greater than 0.5 Po, where Po was the momentum of the accelerated protons. Upper limits are presented for the production of antideuterons and new, long-lived particles with masses below 2.2 GeV. High-resolution gas Cherenkov counters were used for the identification of the particles.
Author (NSA)

N70-28427 Tulane Univ., New Orleans, La.
THE MOESSBAUER EFFECT FOLLOWING COULOMB EXCITATION OF W 183, Hf 178, AND Hf 180
Kenneth Albert Hardy (Ph.D. Thesis) 1969 61 p
Avail: Univ. Microfilms: HC $3.60/Microfilm $3.00 Order No. 69-20482

An experimental apparatus is described which can be used for Mossbauer effect studies using the Coulomb excitation technique or using radioactive sources. The use of a closed cycle helium refrigerator to cool the target (source) and absorber to 12K is discussed. Computer programs are described which compute theoretical Mossbauer absorption spectra, perform gamma ray pulse height spectra stripping, and which use the method of least squares to analyze Mossbauer absorption spectra. The Mossbauer effect was observed in the 46.5 keV state of W-183 following Coulomb excitation with 3.3 MeV protons. The spectrum exhibits a single absorption line with an absorption of 8.1 + or - .5% and a half width of 4.72 + or - .24 cm/sec, which corresponds to a T sub 1/2 = .194 + or - .010 ata sec. The quadrupole moment ratio of Hf-178/Hf-180 was measured using the Coulomb excitation Mossbauer effect. The targets were isotopically enriched HfO2 and the absorber was HfC.
Dissert. Abstr.

N70-28428# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Teoreticheskoi i Eksperimental'noi Fiziki.
ATLAS OF DISTRIBUTIONS
O. N. Baloshin, I. N. Borodina, I. M. Gokhfel'd, V. A. Kolkunov, A. M. Lapidus et al 1969 199 p refs In RUSSIAN
(ITEF-700) Avail: AEC Depository Libraries

A computation of the distributions in the model of the phase space volume with account taken of the resonances and the restrictions on the movement of particles is discussed. The most frequent types of distributions are reduced to the 1 - 2 fold integrals of phase volumes of some sets of particle-blocks. A description is given of use of programs composed in ITEF for computation of distributions and graphics of different distributions, computed using these programs.
Author (NSA)

N70-28431# Union Carbide Corp., Oak Ridge, Tenn. Computing Technology Center.
A USERS MANUAL FOR ASOP ANISN SHIELD OPTIMIZATION PROGRAM
Ward W. Engle, Jr. 8 Sep. 1969 79 p refs
(Contract W-7405-eng-26)
(CTC-INF-941) Avail: CFSTI

ASOP is a one dimensional shield optimization program based on the one dimensional discrete ordinates code, ANISN. The code was written for the IBM/360 and will compile on the IBM FORTRAN 4 H compiler. ASOP cross section data is required to be coupled neutron and gamma ray data. In addition to the material cross sections required to describe the shield and any associated, ASOP requires at least one set of activity cross sections which is used to compute the dose rates due to neutrons and gamma rays.
NSA

N70-28435 State Univ. of New York at Buffalo.
STATIC HYPERPOLARIZABILITIES AND LOW FREQUENCY THIRD HARMONIC GENERATION IN GASES
Arthur Lane Dana (Ph.D. Thesis) 1969 71 p
Avail: Univ. Microfilms: HC $4.00/Microfilm $3.00 Order No. 69-20564

The effects of high intensity electromagnetic radiation upon atoms and molecules in the gaseous state are considered. On the atomic level these effects are treated using quantum mechanical perturbation theory with semiclassical perturbation potentials. The atomic interaction energies and induced electric dipole moments are expressed as power series in the applied fields. Using the time derivative of the macroscopic polarization as a current source term in Maxwell's equations, a set of nonlinear wave equations describing the propagation of electromagnetic radiation in a dilute gas is obtained. For the particular case of third harmonic generation these equations are solved in various approximations, and criteria are established for the validity of the solutions. The generated third harmonic power flux is related to the product of the cube of the input power flux and the squares of the frequency, density, path length, and atomic hyperpolarizability.
Dissert. Abstr.

N70-28436 Polytechnic Inst. of Brooklyn, N.Y.
THEORETICAL INVESTIGATION OF THE PROPERTIES OF THE ODD NUCLEI FROM A = 27 TO 35 IN THE UNIFIED NUCLEAR MODEL
Frank George Bailey (Ph.D. Thesis) 1969 146 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 69-20314

An attempt is made to account for a number of experimentally observed properties of the low lying levels in Mg-27, Si-29, P-29, P-31, S-33, Cl-33, and Cl-35 using the intermediate coupling approach in the Unified Nuclear Model. Each odd mass nucleus is described in terms of the neighboring doubly even nucleus, the last

odd nucleon is described by shell model single particle states. The Hamiltonian matrix is diagonalized in the space of the uncoupled system for values of spin from 1/2 to 7/2. Using physically reasonable values of the parameters, the energies, spins, and parities of the low lying states are calculated for the nuclei considered. The theoretical results are in reasonably good agreement with the available experimental data. In addition to the energy levels, the nuclear moments and electromagnetic transition probabilities were calculated using the eigenfunctions obtained from the diagonalization of the Hamiltonian matrices. Dissert. Abstr.

N70-28437 Ohio State Univ., Columbus.
A CALCULATION OF THE K MESON ELECTROMAGNETIC MASS DIFFERENCE BASED ON THE VENEZIANO REPRESENTATION
David Morris Scott (Ph.D. Thesis) 1969 41 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-22204

An expression for the isovector part of the electromagnetic mass shift of the K mesons is derived from the difference of the first order (in the fine structure constant) electromagnetic self-energies of the positive and neutral kaons. Vector meson dominance is used to relate this part of the mass shift to strong interaction processes. A simplified Veneziano representation (including only one Regge trajectory) in each channel is written for these strong interaction processes. The results are presented in terms of a cut off on the four momentum carried by the virtual photon producing the first order mass shift. A relatively low cut off value of about 3 BeV is required to yield the experimental mass difference. Dissert. Abstr.

N70-28438 Minnesota Univ., Minneapolis.
CHARGE EXCHANGE SCATTERING OF NEGATIVE PIONS ON PROTONS AT HIGH MOMENTUM TRANSFER
Eric William Petraske (Ph.D. Thesis) 1969 49 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-20047

An experiment measuring the differential cross section of the reaction negative pion on protons yields neutral pions and neutrons at incident beam momenta of 2.3,4.5, and 6 Gev/c, using optical spark chambers, is reported. The data are compared with predictions from a Reggeized baryon exchange model of the process. Dissert. Abstr.

N70-28440# Groningen Rijksuniversiteit (Netherlands).
CALCULATIONS OF TOTAL MUON CAPTURE RATES IN NUCLEI
Jan Reindert Luyten (Ph.D. Thesis) 1968 143 p refs
(NP-17979) Avail: AEC Depository Libraries

The basic starting points for the calculation of muon capture rates in nuclei are discussed. The Universal Fermi Interaction hypothesis for muon capture is examined. Muon capture rates for O-16, C-40, C-48, Ti-50, Cr-52, and Fe-54 are calculated and compared with experimental values. Some details of nuclear structure and the muon capture distribution obtained as a by-product in the calculation are presented. NSA

N70-28442# Tokyo Univ. (Japan). Inst. for Nuclear Study.
A CASCADE THEORY UNDER APPROXIMATION C
Akeo Misaki 10 Nov. 1969 11 p refs
(INSJ-112) Avail: AEC Depository Libraries

A cascade theory is developed under approximation C. We shall call "approximation C" the approximation in which one considers a collision process and the Compton effect and uses a more precise formula instead of an asymptotic one to describe the radiation process and pair production. Analytical expressions are given. Author (NSA)

N70-28449 Colorado Univ., Boulder.
INCOHERENT PHOTON SCATTERING FROM BOUND ELECTRONS
Eugene Michael Henry (Ph.D. Thesis) 1969 180 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 69-19542

In second-order perturbation theory the amplitude for transition between two stationary states of a system involves a summation over a complete set of intermediate states of the system. The intermediate states are plane waves for the case of photon scattering from a free electron, and the summation can be performed in closed form. For a bound hydrogenic electron an exact calculation of the transition amplitude must include the effects of the Coulomb field in the intermediate states. The intermediate state summation is performed by means of a relativistic Green's function which retains the full effects of the Coulomb field on the transition amplitude. The results show that binding effects in the intermediate electron states significantly decrease the incoherent scattering function for low momentum transfers from the values predicted by theories which assume free intermediate states. It is concluded that intermediate state binding should not be neglected in photon-electron scattering calculations. Dissert. Abstr.

N70-28450 Pennsylvania Univ., Philadelphia.
STUDY OF THE INTERACTION PION(−) + P YIELDS N + 2 PION(0)
Ronald Francis Gleeson (Ph.D. Thesis) 1969 82 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 69-21356

Observation of an S-wave 2 pion enhancement is reported at 715 Mev of width 150 Mev by the study of the reaction negative pion + P yields N + 2 pion. The momentum of the neutron was measured by the time of flight technique, and lead plate spark chambers were used to determine the four gamma ray directions. Dissert. Abstr.

N70-28462# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.
DISPERSION RELATION AS INTEGRAL EQUATION CONCERNING INELASTICITY COEFFICIENT. IMPOSSIBILITY OF CASTILLIEJO-DALITZ-DYSON CUTS
G. N. Chermalykh 1969 27 p refs Presented at the 3d Conf. on Axiomatical Field Theory and Theory of Elementary Particles, Kiev
(ITF-69-39; CONF-690417-22) Avail: AEC Depository Libraries

The partial-wave dispersion relation (pwdr) is considered as a singular integral equation concerning the inelasticity coefficient eta(nu) with the given real part of the phase shift Re delta(nu) and the imaginary part of the partial-wave amplitude on the left-hand cut. It is shown that the eta(nu) → 1, nu → nu sub i is the inelastic threshold, in Banach space. In the solution for eta as in the N/D−solution of pwdr the CDD ambiguity arises, however in form of an arbitrary polynomial in the solution. It is shown also that the discontinuities in Re delta(nu) by + or − tau/2, resulting in the so-called the CDD cuts, are inconsistent with pwdr. The discontinuities by + or − pi leading to zeros and CDD poles of the D−function in the N/D equations, however, are allowed and change the solution for the eta, in particular the arbitrary polynomial power in the solutions or the additional conditions of the solution existence. Author (NSA)

N70-28470 Catholic Univ. of America, Washington, D.C.
DIELECTRIC RELAXATIONS IN THE SOLID PHASE OF LINEAR POLYMERS WITHOUT SIDE GROUPS
Henning W. Leidecker, Jr. (Ph.D. Thesis) 1969 207 p
Avail: Univ. Microfilms: HC $9.45/Microfilm $3.00 Order No. 69-19850

Published studies of relaxations of solid linear polymers

without side groups are comprehensively reviewed. It is concluded that these materials exhibit four classes of dielectric relaxations. The temperature dependence of the strength of the relaxation and the frequency of maximum absorption of the relaxation are determined for two classes and indicated for the remaining two. The relationship between the relaxations and the morphology of the polymer is discussed for each class. The properties of classical multi-site models of relaxing systems are calculated in detail to indicate their applicability to the observed relaxations. A multi-site model involving both direct and delayed interparticle interactions is thoroughly developed to indicate the effects of these couplings. Relations between these models and the classes of relaxations are discussed. Dissert. Abstr.

N70-28474 Pennsylvania Univ., Philadelphia.
THE PAIR DISTRIBUTION FUNCTION IN THE THEORY OF THE GROUND STATE OF LIQUID HELIUM FOUR
Monhe Howard Lee (Ph.D. Thesis) 1969 179 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 69-21387

A Jastrow function was considered a starting N-body wavefunction on the basis of the demands of the boundary conditions. The Jastrow function is composed of two-body functions which are approximate solutions of the two-body Schrodinger equation with the Lennard-Jones potential. To demonstrate the evident existence of stability the ground state energy must be calculated as a function of density. Utilization of the Jastrow function requires explicit knowledge of the pair distribution function. By using some of the methods developed for classical statistical mechanics, the pair distribution function is calculated, whose solutions are found to be physically based. The calculation of the ground state energy shows that there is a minimum at quite physical density in the energy-density relation, thereby indicating the existence of stability. Dissert. Abstr.

N70-28477 Drexel Inst. of Tech., Philadelphia, Pa.
TRANSPOSITION-INVARIANT SYMMETRY BREAKING IN NON-LINEAR QUANTUM FIELD THEORY
John Anthony Okolowski (Ph.D. Thesis) 1969 95 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 69-19681

It is shown that the quantum theory of the neutral scalar free field admits exact solutions for the vacuum, one-particle, and two-particle stationary states, which are also obtained by using the Rayleigh-Ritz procedure for functionalities. This method is then applied to determine conditions for the existence of approximate vacuum, one-particle, and two-particle stationary states for a theory featuring real scalar fields coupled by a generic gauge invariant nonlinear interaction term and a transposition-invariant gauge symmetry breaking term. Theories for which the interaction energy density divided by the sum of the squares of the fields is uniformly bounded for all values of the fields admit acceptable vacuum, one-particle, and two-particle stationary states. Furthermore, in such theories there is no interaction between two field quanta for the two-particle stationary states, that is, the S-matrix equals the identity operator. Dissert. Abstr.

N70-28480 Tulane Univ., New Orleans, La.
SOME SU(6) SUB w INVARIANT SCATTERING AND DECAY AMPLITUDES
Martha Ella Head (Ph.D. Thesis) 1969 273 p
Avail: Univ. Microfilms: HC $12.40/Microfilm $3.55 Order No. 69-20483

The techniques of SU(6) sub w are used to obtain scattering matrix elements for some collinear relativistic processes involving pseudoscalar mesons, baryons, and baryon resonances. A general method of calculating SU(6) sub w invariant scattering matrix elements by Clebsch-Gordan techniques is discussed. This method is applied to scattering processes with an initial state consisting of a pseudoscalar meson and a baryon. Other scattering amplitudes are presented in terms of the SU(3) Clebsch-Gordan coefficients. Experimental data for the scattering processes are sparse. However, the results of this calculation are compared with the available information using the optical theorem to convert predictions of forward scattering amplitudes to total cross sections. Decay amplitudes for some baryon resonances are also calculated. Dissert. Abstr.

N70-28481# Institute for Nuclear Physics Research, Amsterdam (Netherlands).
STANDARD FLUX OF THERMAL AND EPI-THERMAL NEUTRONS
B. J. Mijnheer and A. H. W. Aten, Jr. [1969] 5 p refs Presented at the Professs. Comm. on Nucl. Phys., Bad Neuenahr, West Germany
(CONF-680461-4) Avail: AEC Depository Libraries

The requirements for a standard neutron flux permitting measurements with bulky instruments are discussed. A standard flux for epithermal neutrons using an Am -Be source is described. NSA

N70-28486# Addis Translations International, Woodside, Calif.
STATIONARY STATE OF A POLARIZED SELF-FOCUSING RING (ACCELERATION OF AN ELECTRON-ION BUNCH)
E. A. Perel'shtein et al [1969] 26 p refs Transl. into ENGLISH from the Russian Report Prepared for California Univ.
(UCRL-Trans-1401; JINR-P9-4423) Avail: CFSTI

The acceleration of a self-focusing electron-ion bunch is discussed. It is shown that when the self-focusing condition, including an allowance for gravitational forces in the uniformly accelerated (Moller) coordinate system, is satisfied, the ring can assume a stationary state. A particular mathematical model of this type of ring is developed. Author (NSA)

N70-28492# National Inst. for Research in Nuclear Science, Chilton (England). Rutherford High Energy Lab.
WIDE ANGLE ELASTIC PROTON-PROTON SCATTERING AT HIGH ENERGIES (DIFFRACTION OR REGGE POLES)
E. J. Sacharidis Oct. 1969 40 p refs
(RHEL/R-186) Avail: AEC Depository Libraries

The final differential cross sections of elastic proton-proton scattering at large angles and high energies which have been measured at CERN in the last few years are presented. One of the experimental arrangements is described, together with the data obtained. The data are compared with measurements of other laboratories, and a brief discussion is included on theoretical attempts to interpret the data. Author (NSA)

N70-28528# Los Alamos Scientific Lab., N. Mex.
DELAYED NEUTRONS AND CHARGE DISTRIBUTION IN FISSION
B. P. Maksiutenko et al Dec. 1969 8 p refs Transl. into ENGLISH from the Russian Report
(LA-TR-69-3; FEI-145) Avail: CFSTI

The charge distribution in the neutron fission of U-238 was studied by expanding the decay wave. The expansion technique depends on previous data on delayed neutron precursors. The decay curve was measured for 5.5-, 6.0-, and 6.9-MeV incident neutrons using a 512-channel analyzer. The charge distributions obtained show a clear energy dependence. NSA

N70-28529# Ceskoslovenska Akademie Ved, Rez. Ustav Jaderneho Vyzkumu.
A COMMENT TO THE BHMM ANALYSIS OF THE DEUTERON STRIPPING
J. Dobes Aug. 1969 6 p refs
(UJV-2261-F) Avail: AEC Depository Libraries

The BHMM theory of deuteron stripping reactions is analyzed and subjected to criticism. Its use in analyses of reactions with spectroscopic factors close to unity is questioned. Author (NSA)

N70-28530# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions.
FUNDAMENTAL ELECTROMAGNETIC PROPERTIES OF A NEUTRON: ELECTRICAL CHARGE, ELECTRICAL DIPOLE MOMENT, ELECTROMAGNETIC FORM FACTORS, POLARIZABILITY, (n-e) INTERACTION
Yu. A. Aleksandrov 1969 54 p refs In RUSSIAN
(JINR-P3-4783) Avail: AEC Depository Libraries

Experimental papers devoted to fundamental electromagnetic properties of a neutron, such as: electric charge, electric dipole moment, electromagnetic form factors, polarizability, and (n-e) interaction are reviewed. Author (NSA)

N70-28531# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
ON THE VIRASORO MODEL FOR PION N-SCATTERING
V. I. Zhuravlev 1970 13 p refs In RUSSIAN
(JINR-P2-4883) Avail: AEC Depository Libraries

The pion N-scattering in Virasoro model is considered. The obtained results are compared with experiment and the Veneziano model predictions. Author (NSA)

N70-28532# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
CALCULATION OF 3rd-ORDER GEOMETRICAL ABERRATIONS IN QUADRUPOLE LENS SYSTEMS
Pierre Tanguy Jan. 1970 108 p refs In FRENCH
(CEA-N-1110) Avail: AEC Depository Libraries

Analytical expressions for the aberration coefficients of quadrupoles are set up for various forms of their characteristic function. The results obtained are used to calculate the aberration coefficients of an arbitrary quadrupole lens system; these coefficients may be used to estimate the importance of aberrations in beam transport systems. A program has been set up to compute the aberration coefficients of an arbitrary quadrupole system. This program does not require numerical integrations and yields accurate values for the aberration coefficients very quickly. Author (NSA)

N70-28556# Toulouse Univ. (France). Faculte des Sciences.
ABSOLUTE MEASUREMENTS OF TOTAL CROSS SECTIONS FOR CHARGE EXCHANGE AND ELECTRON LOSS FOR H1(+), H2(+), H3(+) ION INTERACTIONS WITH A WATER VAPOR TARGET [MESURE ABSOLUE DES SECTIONS EFFICACES TOTALES D'ECHANGE DE CHARGE ET DE PERTE D'ELECTRON POUR DES IONS H1(+), H2(+), H3(+), D'ENERGIE COMPRISE ENTRE 1 ET 60 keV RENCONTRANT UNE CIBLE DE VAPEUR D'EAU]
Daniele Molina (Ph.D. Thesis) Jan. 1970 121 p refs In FRENCH; ENGLISH summary *Its* Order No. 883
(NP-18130) Avail: AEC Depository Libraries

In order to determine the best operating conditions for each type of ion, the behavior of the ion beam was studied for different hydrogen pressures in the source, different source powers and different containment magnetic fields. Then, the mass spectra of the ions coming from the duoplasmatron were studied for hydrogen and other gases such as deuterium, helium, neon, and argon. For detection, a calorimetric detector and a classical electron multiplier were used but the secondary emission coefficients of the cathode had to be determined for each type of ion and neutron studied. H1(+), H2(+), H3(+) ion beams collided with a water vapor target at energies ranging between 1 and 60 keV and their charge-exchange and electron-loss total cross sections were measured. NSA

N70-28558# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Inst. Fiziki Vysokikh Energii.
TWO-PARTICLE REACTIONS AT HIGH ENERGIES IN THE REGION OF OREAR TRANSFERS
V. V. Anisovich and O. A. Khrustalev 1969 14 p refs In RUSSIAN
(IFVE-STF-69-17) Avail: AEC Depository Libraries

In case of large energies the processes run peripherally and multiperipherally, and the constant has the following features: it is similar in the scattering charge-exchange backward scattering processes as well as in processes running with the exchange of nonzero quantum number in t-channel; in the processes A + B yield C + D with the exchange of the nonzero quantum number in the t-channel b = min. A comparison of these features with the experimental data is presented. Author (NSA)

N70-28567# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
PHYSICAL SYMMETRIES IN THE FRAMEWORK OF QUANTUM FIELD THEORY, 2
Jan T. Lopuszanski 1969 18 p refs
(JINR-E2-4832) Avail: AEC Depository Libraries

It is proved that the original free fields and those obtained under the symmetry representation are linked together by a linear representation (nonlocal, in general). Many physicists conjectured these relations to be linear, although no proof was given so far. Author (NSA)

N70-28568# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
HIGH-ENERGY AND HIGH-RESOLUTION SPECTROMETRY USING THE SATURNE BEAM
Jacques Thirion, Paul Birien, and Jean Saudinos Jan. 1970 80 p In FRENCH
(CEA-N-1248) Avail: AEC Depository Libraries

In order to do nuclear physics with particles from the proton synchrotron Saturne in the 1 GeV energy range, a magnetic spectrometer has been designed to give an energy resolution. Because of its natural energy dispersion, the incident beam on target must be magnetically analyzed. The compensation of incident energy dispersion, the elimination of the dispersion due to kinematic effects, and the correction of the geometrical aberrations are described. Characteristics of the different magnets are given and the procedures to get the correct magnetic fields are described. Author (NSA)

N70-28569# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
GAS AND DUST ACTIVATION IN THE TARGET ROOM OF THE SACLAY ELECTRON LINAC. IDENTIFICATION OF THE PRODUCED RADIOACTIVE NUCLEI AND DETERMINATION OF THE REJECTED ACTIVITIES
H. Vialettes [1969] 17 p refs Presented at the 2d Intern. Conf. on Accelerator Dosimetry and Experience, Stanford, Calif.
(CEA-CONF-1433; CONF-691101-13) Avail: AEC Depository Libraries

The first runs of the Saclay Electron Linac (A.L.S.) with high power beam (330 to 560 MeV, 100 kW on the target) held from July to November 1968 are considered. During this time, the usual checks of the shielding efficiency were made, and the problem of gas and duct activation in the room where the beam reaches the target was studied. The first study to identify the radioactive nuclei produced and to estimate the risks for people entering the target room immediately after the shut-down of the accelerator or for people staying in the cloud emerging from the stack is described. Radionuclides have been identified by their gamma-spectrum and half-life. The devices used for air sampling and analyzing and the interpretation of the results to determine the concentration of rejected active products are discussed. Author (NSA)

N70-28572# Utrecht State Univ. (Netherlands).
INELASTIC AND ELASTIC SCATTERING OF ELECTRONS BY ATOMS (EXPERIMENTS AND THEORIES)

Leendert Vriens (Ph.D. Thesis) 1968 87 p refs
(NP-18037) Avail: AEC Depository Libraries

A crossed-beam experiment is described, and electron impact cross sections for excitation to the metastable states of helium and for ionization from these states and from the ground state are reported. Analytical extrapolation techniques and integrating also yielded total cross sections. The results for exchange scattering cast serious doubt upon the validity of all exchange approximations used up to now in cross section calculations. The class of approximate treatments of atomic collisions starts with caclulating the probability of an encounter in which a definite amount of momentum is transferred from an incident particle to one of the electrons in a target system, and then makes realistic assumptions about the initial conditions of the target electrons to obtain a cross section for an inelastic process of interest. Contributions are made in three ways to this field: first, in deriving a rather complete set of exact cross-section formulas for a pair of free colliding charged particles in an arbitrary frame in nonrelativistic quantum mechanics; second, in the application and choice of approximate models to calculate atomic cross sections; third, in testing the range of validity of this approximate theory. Author (NSA)

N70-28604 European Organization for Nuclear Research, Geneva (Switzerland). Nuclear Physics Div.
OUTLINE OF THE ISOLDE PROJECT
G. Rudstam and A. Kjelberg *In its* The ISOLDE Isotope Separator On-Line Facility at CERN 19 Jan. 1970 p 1-15 refs (See N70-28603 14-22)
Copyright. Avail: Issuing Activity

A program is described for investigating the properties of nuclides far off the beta-stable region of the nuclear energy surface. A general discussion is given for the instrumental arrangement, where the target exposed to irradiation is attached to the measuring instruments by a series of apparatuses for chemical separation, isotope separation, collection of samples, and transportation of samples to the detectors. R.B.

N70-28611 European Organization for Nuclear Research, Geneva (Switzerland). Nuclear Physics Div.
PERFORMANCE OF THE ISOLDE TARGET SYSTEM
E. Hagebo, Al Kjelberg, P. Patzelt, G. Rudstam, and S. Sundell *In its* the ISOLDE Isotope Separator On-Line Facility at CERN 19 Jan. 1970 p 93-107 refs (See N70-28603 14-22)
Copyright. Avail: Issuing Activity

The technical performance of the mechanical parts in the isotope separator target system, as well as the physical and chemical behavior of the target materials under operational conditions, are discussed. Surveys were made for several elements to determine the sample strength obtainable. The factors affecting the delay between the production of nuclides of short half-lives in the target material and their collection are considered. Author

N70-28613 European Organization for Nuclear Research, Geneva (Switzerland). Nuclear Physics Div.
ON THE DELAY BETWEEN PRODUCTION AND MEASUREMENT IN SEPARATOR-ON-LINE SYSTEMS FOR THE STUDY OF SHORT-LIVED NUCLIDES
G. Rudstam *In its* The ISOLDE Isotope Separator On-line Facility at CERN 19 Jan. 1970 p 123-140 refs (See N70-28603 14-22)
Copyright. Avail: Issuing Activity

The time loss between the production of a nuclide and its collection in front of the measuring instruments is investigated for short-lived nuclides. A quantitative analysis is made of such nuclides to evaluate their effect on optimization of experimental conditions. Author

N70-28631*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ROTATIONAL EXCITATIONS OF MOLECULES BY COLLISION WITH ATOMS
F. H. M. Faisal May 1970 18 p refs Submitted for publication
(NASA-TM-X-63924; X-641-70-153) Avail: CFSTI CSCL 20H

First order semiclassical scattering theory is used to estimate the rotational excitation cross sections of N2 by Ne impact. Results are compared with available quantal calculations. Linear trajectories are assumed for the heavy atomic projectiles. The solution is obtained analytically. Author

N70-28632# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
HIGH-ENERGY INTERACTIONS OF GAMMA-QUANTA WITH NUCLEI
K. K. Gudima, A. S. Il'inov, and V. D. Toneev 1969 10 p refs In RUSSIAN
(JINR-P2-4808) Avail: AEC Depository Libraries

The calculation results are presented for the photo-nuclear reactions at high energies obtained by means of cascade model suggested previously. A good agreement of theory and experiment on the total characteristics both for light and heavy nuclei is noted. Author (NSA)

N70-28634# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Neutronenphysik und Reaktortechnik.
ACTUAL CONDITION OF THE PHYSICAL KNOWLEDGE OF THE MOST IMPORTANT NUCLEAR REACTOR DATA
J. J. Schmidt Apr. 1969 36 p refs In GERMAN Presented at the Reactor 1 Meeting of the German Atomforum, Frankfurt am Main
(KFK-986; EUR-4172; EANDC(E)-117-U; CONF-690419-2) Avail: AEC Depository Libraries

A review is presented of the bibliographic data on the alpha decay of Pu-239, the capture cross sections for U-238 and Pu-240, the fission cross sections for U-235, Pu-239 and Pu-240, and the nu factors for Pu-239 and Cf-252. NSA

N70-28638# Daresbury Nuclear Physics Lab. (England).
EXPERIMENTAL UTILISATION OF A NINA BOOSTER
P. G. Murphy and A. B. Clegg, eds. 1969 68 p refs
(DNPL/R-3) Avail: AEC Depository Libraries

Some possibilities for physics experiments on this 20-GeV booster are outlined, with a view to justifying its construction; these include: photoproduction of phi-mesons in the range 5 to 20 GeV/c; photoproduction of complicated final states; electroproduction of N*(1236) isobar; electroproduction of rho(0)-mesons; electroproduction of neutral mesons; yields of mesons from a 20 GeV electron synchrotron; K(0) beams; experiments with muon beams; and photoproduction of lepton pairs. Author (NSA)

N70-28643# Istituto Nazionale di Fisica Nucleare, Milan (Italy).
THE CERN-TRIESTE MAGNETOSTRICTIVE WIRE SPARK CHAMBERS SYSTEM FOR THE LOW ENERGY PION DEUTERON AND PION PROTON SCATTERING EXPERIMENT AT THE CERN PROTOSYNCHROTRON
F. Bradamante, S. Conetti, G. Fidecaro, M. Fidecaro, M. Giorgi et al 1 Jun. 1969 92 p refs Supported in part by CERN
(INFN/AE-69-7) Avail: CFSTI

The system of wire spark chambers with magnetostrictive readout used in a low energy elastic scattering experiment is described. Details of the construction of the chambers, electronic readout, the data acquisition system, and the reconstruction program are given. The precision attained in the experiment as a function of the various parameters of the system is discussed. Author

N70-28650# Maryland Univ., College Park. Dept. of Physics and Astronomy.
HIGH-ENERGY ELECTROPRODUCTION AND THE [illegible]

SQUARED) (SIGMA SUB L) - Ó AS q SQUARED APPROACHES - INFINITY
R. Chanda, S. Sen, and D. P. Majumdar (Syracuse Univ.) Nov. 1969 9 p Supported by AEC
(SU-1206-217; NYO-3399-217) Avail: CFSTI

It is shown that the result can be obtained without making any explicit assumptions regarding the nature of the constituents of the hadronic electromagnetic current. Author (NSA)

N70-28652 State Univ. of New York at Buffalo.
DYNAMIC POLARIZABILITY, REFRACTIVE INDEX, VERDET COEFFICIENTS, AND SHIELDING FACTORS OF CLOSED-SHELL ATOMS AND IONS
V. G. Kaveeshwar (Ph.D. Thesis) 1969 115 p
Avail: Univ. Microfilms; HC $5.60/Microfilm $3.00 Order No. 69-20529

The interaction of plane polarized electromagnetic waves with S-state atoms is discussed. More specifically, the theory contained herein is a semiclassical treatment whereby the external fields are characterized by the classical Maxwell equations and the atomic behavior is characterized by time-dependent quantum mechanical perturbation theory. A new formulation of time-dependent Hartree-Fock perturbation theory is developed using the phase factor method of Chung. This theory is then applied to He, Be, and Ne and to the corresponding 2-, 4-, and 10- electron isoelectronic series. In particular, the dynamic polarizability, Verdet coefficients, refractive index, and dynamic shielding factors are evaluated for these systems using the fully coupled Hartree-Fock theory developed here. Dissert. Abstr.

N70-28653 Iowa State Univ. of Science and Technology, Ames.
LIFETIMES OF DEEPLY EMBEDDED POSITRONS IN METALS
Wallace William Souder (Ph.D. Thesis) 1969 185 p
Avail: Univ. Microfilms; HC $8.40/Microfilm $3.00 Order No. 69-20673

Measurements of mean lifetimes of positrons deeply imbedded in metals were made. The resolving power of the apparatus with one channel accepting the top 30% of the 1.33 MeV spectrum and the other channel accepting the top 15% of the 0.511 MeV spectrum is represented by a full width at one-half the maximum of the prompt curve of 214 psec. Nuclear isotopes that emit positrons were created deep within samples by photonuclear reactions induced by the bremsstrahlung radiation of an electron synchrotron. The positron annihilation rate was shown to depend upon surface effects by measuring the lifetimes of positrons in samples of nickel in which varying percentages of annihilations occurred near the surface. The mean lifetime of positrons deeply imbedded in a large single crystal of nickel was found to be 119 + or - 5 psec. The value of 186 + or - 6 psec was measured for positrons annihilating in the conventional sandwich sample made from two nickel single crystals. Dissert. Abstr.

N70-28681# State Univ. of New York, Stony Brook. Dept. of Physics.
BUBBLE CHAMBER GROUP Progress Report, 1 Jan. - 31 Dec. 1969
31 Dec. 1969 62 p
(Contract AT(30-1)-3668)
(TID-25338) Avail: CFSTI

The Stony Brook Bubble Chamber Group in the preceding year (its fourth year of operations) has continued its investigations of hyperon leptonic decays, resulting in a determination of the G sub V/G sub A value for the Lambda hyperon beta-decay; the G sub V/G sub A value for the Epsilon hyperon beta-decay; and the partial decay rate of the Epsilon hyperon into muon, neutron and neutrino. The last two were done in collaboration with the Columbia University Bubble Chamber Group. Two other experiments are also in progress. First, an optical spark chamber experiment was run at the Princeton-Pennsylvania Accelerator in the spring of 1969 as a joint Stony Brook-Columbia effort to determine the branching ratio Ks yields positive pion + negative pion/Ks yields neutral pion + neutral pion. For this experiment, at Stony Brook, all the Lambda event candidates in the film resulting from the associated production negative pion + proton yields neutral Lambda + neutral K meson were extracted. This will lead to a result in the aforementioned branching ratio in the next year. Author (NSA)

N70-28686 Johns Hopkins Univ., Baltimore, Md.
LINEAR POLARIZATION OF X-RAY BREMSSTRAHLUNG AS OBSERVED FROM A VAPOR TARGET X-RAY TUBE
Ronald J. Koch (Ph.D. Thesis) 1969 116 p
Avail: Univ. Microfilms; HC $5.80/Microfilm $3.00 Order No. 69-21088

The linear polarization of x-rays produced by electron bombardment of a mercury vapor target is analyzed with a Barkla polarimeter as a function of electron bombardment energy, x-ray photon energy, and emission angle. This is accomplished by measuring the scattered intensity from a beryllium scatterer perpendicular and parallel to the emission plane defined by the directions of the incident electron and the x-ray photon. A xenon-methane filled proportional counter and high resolution spectroscopy amplifiers allow the energy resolution to be accomplished by pulse eight analysis. Comparison with the Sommerfeld theory of the continuous x-ray spectrum is given, as are conclusions concerning its validity. A least square procedure for unfolding the pulse height distribution of the scattered spectrum and eliminating the effect of the characteristic radiation to obtain the original differential energy spectrum is also presented. Dissert. Abstr.

N70-28688*# National Aeronautics and Space Administration Goddard Space Flight Center, Greenbelt, Md.
VIBRO-ROTATIONAL EXCITATIONS OF H2(+) BY a(+) IMPACT: A SEMI-CLASSICAL APPROACH
F. H. M. Faisal Jun. 1970 24 p refs Submitted for publication
(NASA-TM-X-63931; X-641-70-206) Avail: CFSTI CSCL 20H

Analogies between Coulomb excitations of nuclei and ionic molecules by charged projectiles are utilized to calculate vibro-rotational excitations of H2(+) molecular ions by positron impact by a semiclassical method developed in the nuclear case. Author

N70-28692# Lyon Univ. (France). Inst. of Nuclear Physics.
SEPARABLE POTENTIALS IA ALPHA-ALPHA ELASTIC SCATTERING BELOW 30 MeV
J. Pigeon, J. Barguil, C. Fayard, C. Lambot, and E. El Baz 8 Dec. 1969 24 p refs
(LYCEN-6955) Avail: AEC Depository Libraries

The use of non-local separable potentials leads to a simple analytical expression for the elastic scattering processes, even when the Coulomb effect is taken into account. The nuclear phase shift is given by an explicit formula identical to that in the neutral particle case, except that the separable potential is expressed by representation. The formalism described has been used in alpha-alpha elastic scattering below 30 MeV. The parameters concerned have been determined by comparison with experimental data, and close agreement with the experimental nuclear phase shift has been obtained. NSA

N70-28694# Comision Nacional de Energia Atomica, Buenos Aires (Argentina).
THE COLLECTIVE STATE OF NUCLEAR PAIRS WITH QUADRUPOLE DEFORMATION [ESTADOS COLECTIVOS DE NUCLEOS PARES CON DEFORMACION CUADRIPOLAR]
Jose F. Suarez 1969 19 p refs In SPANISH; ENGLISH

summary
(CNEA-240) Avail: CFSTI

Surface vibrations of even nuclei with quadrupole deformation are taken into account to compute the contribution of rotations to nuclear spectra. The complete range 0 equal to or less than gamma sub 0 equal to or less than 30 deg is covered with the same solution for the Hamiltonian equation. The agreement with the *small vibrations* hypothesis is better than that obtained with previous models. Author

N70-28710# California Univ., Berkeley. Lawrence Radiation Lab. Dept. of Physics.
NUCLEAR SPINS, 3 P1 and 3 P2 HYPERFINE STRUCTURES, AND NUCLEAR MOMENTS OF Ge 69 AND Ge 75 AND 3 P2 HYPERFINE STRUCTURE OF Ge 71
Abiodun F. Oluwole (Ph.D. Thesis) 10 Sep. 1969 95 p refs
(Contract W-7405-eng-48)
(UCRL-19338) Avail: CFSTI

The atomic beam magnetic resonance (ABMR) technique was used to measure the nuclear spin and the hyperfine structure (hfs) constants for germanium isotopes. Nuclear moments were inferred by the use of the Fermi-Segre formula from the corresponding hfs interaction constants. Author (NSA)

N70-28737*# Virginia Polytechnic Inst., Blacksburg.
MUONIC INTERACTIONS Zn 66 AND Zn 68
D. A. Jenkins, R. J. Powers, and A. R. Kunselman (Wyoming Univ.) [1970] 16 p refs
(Grant NGL-47-004-008)
(NASA-CR-110215) Avail: CFSTI CSCL 20H

The charge radius of Zn-68 was measured and the 2s-1s muonic energy difference was derived. Zn-68 was chosen because the energy of the 0(+) excitation is close to the energy difference of the 2s-1s mu-atomic levels thus allowing a dynamic interaction between a muon in a 2s state and the nucleus in the ground state. It was found that the 2s-1s level difference is 20 KeV less than the nuclear excitation energy and, as a result, the dynamic interaction is too small to observe. The 2p-1s X-ray energy in Zn-66 was measured and the isotope shift in the muonic 2p-1s transition between Zn-66 and Zn-68 is reported. D.L.G.

N70-28738# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
PARTICLE LOSS THROUGH SCATTERING OF SYNCHROTRON RADIATION [TEILCHENVERLUSTE DURCH STREUUNG DER SYNCHROTRONSTRAHLUNG]
A. Piwinski Dec. 1969 16 p refs In GERMAN; ENGLISH summary
(DESY-69/52) Avail: AEC Depository Libraries

It is shown that in electron and positron storage rings at high energies the scattering of the synchrotron radiation on particles in the same bunch can lead to particle losses. With increasing energy and particle density this effect is a sharp limit for the stored beam current. Author (NSA)

N70-28742*# Wisconsin Univ., Madison. Theoretical Chemical Inst.
CROSSED MOLECULAR BEAM STUDY OF THE REACTIVE SCATTERING OF K + I2: PRODUCT KI RECOIL (VELOCITY-ANGLE) DISTRIBUTIONS AND ENERGY DEPENDENCE OF REACTION CROSS SECTION
Kieth Thomas Gillen (Ph.D. Thesis) 26 Feb. 1970 292 p refs
(Grant NGL-50-002-001; Contract AT(11-1)-321; Grant NSF GB-16665)
(NASA-CR-110188; WIS-TCI-380X) Avail: CFSTI CSCL 20H

A molecular beam study of the reaction of a velocity selected potassium beam crossed with a thermal iodine beam is described. Velocity analysis yielded the laboratory recoil velocity-angle distribution of product KI flux. The energy dependence of this flux distribution was determined from measurements over a range of K velocities. Computational methods have been developed which extract the center of mass (c.m.) differential reactive cross section functions (angular and recoil energy distributions) from the laboratory data. The c.m. differential solid angle-recoil velocity distribution is largest at small angles from the initial K beam direction and low KI c.m. velocities. The product angular and recoil velocity distributions are coupled. An increase in the relative collision energy from 1.9 to 3.6 kcal/mole produces only a slight change in the shape of the c.m. product differential cross section functions, accompanied by a small decrease in the magnitude of the reactionpss section. Measurements were also made on the angular and velocity distributions of the nonreactively scattered I over the same energy range. Author

N70-28747# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
NEUTRON THERMALIZATION STUDIES [AT THE SACLAY CENTER]: DATA LIBRARIES, METHODS, AND CODES FOR CELL CALCULATION [THERMALISATION DES NEUTRONS: BIBLIOTHEQUE DE DONNEES METHODES ET CODES DE CALCUL DES CELLULES]
Michel Livolant Jan. 1970 34 p refs In FRENCH
(CEA-N-1243) Avail: AEC Depository Libraries

Calculation methods and computation facilities available at the Service of Mathematical Physics of the Saclay Nuclear Center for nuetron transport thermalization problems, and special reactor cell problems are described. The first part deals with cross sections. A brief review of the formalism used for obtaining transfer cross sections in the harmonic approximation from the fundamental experimental data is given. The sequence of codes used to obtain multigroup cross sections and G and H functions is described. The reactor cell calculation methods are the subject of the second part. A detailed comparison of the various codes (accuracy, physical and geometrical possibilities, computation time) provides a general check of their validity and gives the information needed to choose the most convenient one for each physical situation. Author (NSA)

N70-28764# Institute of Nuclear Physics, Krakow (Poland).
PROCEEDING OF THE 9th CRACOW SCHOOL OF THEORETICAL PHYSICS, VOLUME 2
Jun. 1969 222 p refs Conf. held at Kalatowki, Poland, Jun 1969
(INP-682) Avail: AEC Depository Libraries

Conference papers are summarized on elastic scattering of hadrons at high energy, double peripheral model in Kaon-proton reactions, overlap function calculation in strong interactions, quark models, applications of finite energy sum rules, unitarity of very high frequency scattering and separation of two groups of degrees of freedom, and high energy scattering from nuclei. NSA

N70-28772# Scientific Translation Service, Ann Arbor, Mich.
INTERACTION CROSS SECTIONS OF HIGH ENERGY PARTICLES WITH ATOMIC NUCLEI
S. M. Eliseev [1969] 7 p refs Transl. into ENGLISH from the Russian Report Transl. for Oak Ridge Natl. Lab.
(ORNL-TR-2235; JINR-P2-4509) Avail: CFSTI

To calculate nuclear cross sections in the energy range from several hundreds of MeV and more the Glauber theory can be used. For heavy nuclei the theory gives results not more accurate than for a usual optical model. Author (NSA)

N70-28777# Paris Univ., Orsay (France). Lab. de l'Accelerateur Lineaire.
INTRODUCTION TO REGGE POLES
L. Jaunsau Jul. 1969 122 p refs
(LAL-1220) Avail: AEC Depository Libraries

Topics covered are: Strong interactions; kinematics of two-body

reactions; crossing symmetry and Mandelstam hypothesis; short review of the theory of analytic functions; poles, bound states and resonances; Regge poles in potential theory; Regge poles in high energy hadronic interactions; the simple Regge model vs experience.
Author (NSA)

N70-28799*# Brown Univ., Providence, R.I.
MOLECULAR BEAMS IN CHEMISTRY
E. A. Mason, J. E. Jordan (MIT), and I. Amdur (MIT) [1969] 136 p refs Sponsored in part by Navy and NSF Prepared in cooperation with MIT
(Grant NGL-40-002-059)
(NASA-CR-110011) Avail: CFSTI CSCL 20H

The field of molecular beam research is related to chemical problems. Single, many, and two particle interactions were studied. Theoretical backgrounds were given for elastic, inelastic, and rearrangement collisions. Experimental methods used included low energy, high energy, and intermediate energy beams. Results are presented for elastic, inelastic and reactive scattering. S.S.

N70-28810*# Techtran Corp., Glen Burnie, Md.
STUDY OF ROTATIONAL AND OSCILLATORY DISTRIBUTIONS OF MOLECULES EXCITED IN DIFFERENT ELEMENTARY PROCESSES AND SIGNIFICANCE OF THESE STUDIES FOR ASTROPHYSICS [ISSLEDOVANIYE VRASHCHATELNYKH I KOLEBATELNYKH RASPREDELENIY MOLEKUL, VOZBUZHDENNYKH V RAZLICHNYKH ELEMENTARNYKH PROTSESSAKH, I ZNACHENIYE ETIKH ISSLEDOVANIY DLYA ASTOFIZIKI]
G. N. Polyakova et al Washington NASA May 1970 12 p refs Transl. into ENGLISH from Probl. Kosmich. Fiz., No. 4, 1969 p 103-111
(Contract NASw-2037)
(NASA-TT-F-13058) Avail: CFSTI CSCL 20H

Experimental study of the rotating and oscillating spectra in a diatomic molecule excited by slow and fast electrons is presented. The Boltzmann distribution of excited molecules with respect to the rotational energy levels is given and population of these levels in accordance to the Franck-Condon principle indicate that the excitation was made by a beam of fast particles (electrons or ions). Deviations from this Boltzmann distribution and their significance are described. Author

N70-28813*# Yale Univ., New Haven, Conn. Dept. of Physics.
THEORY OF COLLISION EFFECTS ON LINE SHAPES USING A QUANTUM MECHANICAL DESCRIPTION OF THE ATOMIC CENTER OF MASS MOTION: APPLICATION TO LASERS
Paul R. Berman and Willis E. Lamb, Jr. [1969] 79 p refs
(Grants NGR-07-004-035; AF-AFOSR-249-67; AF-AFOSR-1324-67)
(NASA-CR-110197) Avail: CFSTI CSCL 20H

The Schroedinger equation is solved for an active atom immersed in a medium of perturbing atoms and subject to an external classical electrical field. A series of simplifying assumptions or approximations was constructed for deriving the leading terms of a perturbation solution to the problem. Taking the perturber atoms rigidly fixed in the medium, the time development of the active atom was followed to first order in the external field and to lowest order in the collision interaction. The result for all orders in the scattering interaction is generalized at each individual perturber site so that the resultant expressions reflect the case of single collision for the active atom. From the assumptions, a general expression is derived for the average polarization function of a laser medium. Straight line collision paths and equal collision interaction in both radiative states are investigated. Author

N70-28842# Oak Ridge National Lab., Tenn.
A REVIEW OF MULTIGROUP NUCLEAR CROSS SECTION PREPARATION THEORY, TECHNIQUES, AND COMPUTER CODES
D. K. Trubey and Jane Gurney, comps. Jan. 1970 185 p refs
(Contract W-7405-eng-26)
(ORNL-RSIC-27) Avail: CFSTI

Summaries are presented of papers given at a seminar-workshop on Multigroup Cross Section Preparation – Theory, Techniques, and Computer Codes. The papers, in their review of the state-of-the-art, show that great progress has recently been made in coping with what is the most important problem in radiation transport – cross sections. The papers describe the large number of computer codes, techniques, and data files now available for cross section preparation for use in transport codes. The recently developed codes SUPER-TOG, XSDRN, and DOT-II have been placed with the Radiation Shielding Information Center for routine dissemination. NSA

N70-28843# Pittsburgh Univ., Pa. Dept. of Physics.
SOLUTION OF THE EQUATIONS OF MOTION IN CLASSICAL AND QUANTUM THEORIES
I. Bialynicki-Birula Jan. 1970 37 p refs
(Contract AT(30-1)-3829)
(NYO-3829-45) Avail: CFSTI

The relationship between the time dependence of quantum operators in the Heisenberg picture and the time dependence of the corresponding dynamical variables in the underlying classical theory is discussed. This problem is studied in the non-relativistic particle mechanics and in the field theory. It is shown how the operator solutions of the quantum equations of motion are related to the corresponding solutions of the classical equations of motion. An explicit formula is given, which expresses quantum operators in the Heisenberg picture in terms of their classical counterparts. This formula is particularly useful in the study of the classical limit, of the quantum theory. The dependence on $\hbar$ of the matrix elements of the coordinate and field operators is explicitly given, which enables one to study quantum corrections to the classical theory in all orders. Coherent states of the quantum system play an essentially role in the formalism. Author (NSA)

N70-28864# Oak Ridge National Lab., Tenn. Neutron Physics Div.
VARIATION OF THE R-MATRIX
A. J. Mockel and R. B. Perez 9 Jan. 1970 40 p refs Sponsored by AEC
(ORNL-TM-2816) Avail: CFSTI

The R-matrix of Wigner and Eisenbud is a functional of a set of parameters as well as of the energy of the incoming particle. Invariant embedding techniques were applied, which give the variation of the R-matrix with respect to changes of the parameters entering in the theory. A generalization of various formulas, derived originally by Wigner and Teichmann and Wigner, to the multichannel case was obtained. The general results apply also to deformations of the nucleus other than spherical. An application of the invariant embedding technique is also shown concerning Robson's theory of the isobaric spin analogues. Author (NSA)

N70-28868# Los Alamos Scientific Lab., N.Mex.
MAGNETIC RECORDING OF NEUTRON CROSS-SECTION DATA FROM AN UNDERGROUND NUCLEAR EXPLOSIVE SOURCE
H. D. Arlowe (Sandia Labs., Albuquerque, N.Mex.) and A. F. Furnish 24 Sep. 1969 5 p refs Prepared in cooperation with Sandia Corp., Albuquerque, N.Mex.
(Contracts W-7405-eng-36; AT(29-1)-789)
(LA-4277) Avail: CFSTI

A small portion of the neutron cross-section data obtained from physics shot B (event at the Nevada Test Site) was recorded in frequency modulation form on a rotating hard-surfaced magnetic

disc. This is a novel way of recording these data. Magnetic recording allows electronic digitizing of the data, and thus eliminates the need for time-consuming film reading. Author (NSA)

N70-28871# Brookhaven National Lab., Upton, N.Y.
HIGH-ENERGY INTERNAL CONVERSION ELECTRONS EMITTED FROM Sm 150 AND Gd 158 NUCLEI IN THE (n,GAMMA) REACTION
Yu. N. Panin et al Nov. 1969 16 p refs Transl. into ENGLISH from the Russian Report
(BNL-TR-306; IAE-1832) Avail: CFSTI

A magnetic spectrometer with a resolution of 0.38% was used to measure the conversion electron spectra from transitions in Sm-150 and Gd-158 following neutron capture in Sm-149 and Gd-157. Internal conversion coefficients and multipolarities were determined for a large number of transitions with energies above 5 MeV. NSA

N70-28885# National Bureau of Standards, Washington, D.C. Center for Radiation Research.
PHOTONUCLEAR DATA INDEX, JANUARY 1965-JANUARY 1970
May 1970 88 p refs Supersedes NBS-Misc-Publ-277-Suppl-1
(NBS-SP-322; NBS-Misc-Publ-277-Suppl-1) Avail: SOD $0.75

This index primarily covers data published in the period dated January 1, 1965 through January, 1970. Organized by element and isotope, each entry in the index is for a specific reaction reported in a given reference. Information is given on the type of measurement, excitation energies studied, source type and energies, detector type and angular ranges covered in the measurement. Author

N70-28891# Oak Ridge National Lab., Tenn. Health Physics Div.
ELECTRON IMPACT EXCITATION AND IONIZATION STUDIES OF THE RARE GASES
J. T. Grissom (Ph.D. Thesis—Tennessee Univ., Knoxville) Mar. 1970 163 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2618) Avail: CFSTI

The trapped electron technique was used in conjunction with the retarding potential difference technique to measure the electron impact excitation spectra of He, Ne, and Ar from the energy threshold of the first excited state up to approximately 80 eV with an energy resolution of 0.1 eV to 0.3 eV. Below the ionization threshold the excitation spectra exhibit structure corresponding to the usual singlet-singlet and singlet-triplet transitions. In the slow-electron continuum region above the ionization potential the spectra were found to have structure in the energy regions corresponding to p subshell double-electron excitation and s subshell single-electron excitation. In addition, at least some and possibly many of the spectral features in these energy regions may be due to interference resonances resulting from the formation of negative ion compound states in the electron scattering interaction. Author (NSA)

N70-28909# Kernforschungsanlage, Juelich (West Germany). Zentralinst. fuer Angewandte Mathematik.
ON THE PROBLEM OF THE EIGENVALUES OF THE NEUTRON TRANSPORT EQUATION [ZUM PROBLEM DER EIGENWERTE DER NEUTRONEN-TRANSPORT-GLEICHUNG]
Franz Ebersoldt Dec. 1969 32 p refs In GERMAN
(JUL-632-MA) Avail: CFSTI

The essential spectral properties of the linear Boltzmann-operator B on a subspace of the complex L2 are compiled. The eigenvalue problem for a finite body with convex boundaries, in which particles flow from the outside, is examined. The results are opposed to those obtained for the monoenergetic, isotropic neutron transport in an infinite plate (flat problem), and with thermalization in finite media. Criteria for the existence of eigenvalues are indicated. ESRO

N70-28934# California Univ., La Jolla.
A TEST OF THE DELTAS=DELTA Q RULE IN NEUTRAL K-e3 DECAY
Laurence Stephen Littenberg (Ph.D. Thesis) Dec. 1969 167 p refs
(Contract (AT(11-1)-GEN-10)
(UCSD-10-P-10-107) Avail: CFSTI

Neutral K-e3 decay in the kaon(0)-antikaon(0) interference region was studied. The K(0)'s were produced by the charge exchange of a 1 GeV/c separated K(+) beam. The three charge exchange targets were separated by spark chambers to allow determination of the charge exchange point. The K's decayed in a thin foil spark chamber situated in a magnetic field. Electrons were identified by their showers in a 12 gap spark chamber with 1/8 inch lead plates between the gaps. One and three-tenths million pictures were scanned to obtain approximately 40,000 leptonic candidates from which 686 events were selected. The lifetime distributions of the selected positron pion(-) antineutrino and electron pion(+) neutrino events were fit to the theoretical distributions and the ratio of Delta S = -Delta Q amplitude to the Delta S = Delta Q amplitude was found. Author (NSA)

N70-28935# Brandeis Univ., Waltham, Mass. Dept. of Physics.
PHENOMENOLOGICAL CURRENT ALGEBRA VERTEX
Michael L. Wise (Ph.D. Thesis) Jun. 1969 166 p refs
(Contract AT(30-1)-3178)
(TID-25343)

The most general vertex function determined by the current algebra is constructed. Though the vertex function of three vector currents is emphasized, the methods employed are readily generalized. It is found that the vertex function naturally separates into two parts, a canonical part and a noncanonical part. The origin of the possible breakdown of the Johnson-Low-Bjorken theorem is investigated and a generalized Bjorken theorem is presented. The methods developed are applied to the pion rho-meson A1 system. The decays A1 yields rho-meson pion and rho-meson yields pion pion are parameterized in a convenient manner. Since a realistic model may require an underlying fermion field, subtracted representations for the propagators are derived and the regularized Ward identities for the currents are investigated. It is concluded that whereas current algebra will greatly restrict the class of strong interaction models, additional dynamical information must be found to enable one to calculate the remaining undetermined scalar functions. Author (NSA)

N70-28949# Chicago Univ., Ill. Enrico Fermi Inst.
REGGE CUTS AND THE VENEZIANO MODEL IN BACKWARD PION NUCLEON SCATTERING
R. F. Amann Dec. 1969 36 p refs
(Contract AT(11-1)-264)
(COO-264-529; EFI-69-100) Avail: CFSTI

The Reggeized absorptive cut is included in three Regge pole (the delta, N sub alpha, and N sub gamma) fits to backward pion nucleon-nucleon pion differential cross sections. The overall framework of the Veneziano model is used and successful fits are found with smooth one- parameter residues. The cuts remove the Veneziano model's contradictions with experiment, are essentially parameterless, and are definitely nonnegligible. Methods to verify their presence are discussed. The usual difficulty in extrapolating to the delta mass (too small a width) remains unresolved. Possible explanations of this problem are discussed. Author (NSA)

N70-28952# Pittsburgh Univ., Pa. Dept. of Physics.
EXACTLY SOLUBLE MODEL OF RELATIVISTIC FIELD THEORY

I. Bialynicki-Birula Dec. 1969 10 p
(Contract AT(30-1)-3829)
(NYO-3829-43) Avail: CFSTI

An exactly soluble model of relativistically invariant and local quantum field theory is described. It satisfies all the usual postulates except the requirement of the positive definiteness of either the energy or the metric in the space of state vectors. The S operator is nontrivial and is explicitly given. The two-particle scattering amplitude is calculated. Various generalizations of the model are possible. Author (NSA)

N70-28954# Brown Univ., Providence, R.I. Dept of Physics.
SPIN-TWO MESONS, THE STRESS TENSOR, AND A FIELD-SOURCE IDENTITY. 2: COVARIANCE CONDITIONS AND CONSISTENCY REQUIREMENTS
K. Raman Dec. 1969 39 p refs Sponsored in part by AEC
(NYO-2262-TA-215) Avail: CFSTI

The constraints imposed by Lorentz covariance on a theory with a field-source identity are derived and discussed. It is shown that the field-source identity determines the parts of the singular terms in the stress-tensor equal-time commutation relations which are the most singular in the coupling strength g. It further requires that some of the singular terms be q-numbers. The constraints imposed on the field dependence of the source J sub mu nu(x) by the field-source identity and the Lorentz covariance conditions are obtained. It is shown that as a consequence of some of these, the interaction term must be nonlinear in the coupling strength g. Author (NSA)

N70-28968# Kernforschungsanlage, Juelich (West Germany). Zentralinst. fuer Angewandte Mathematik.
SOLUTION OF THE STATIONARY NEUTRON TRANSPORT EQUATION FOR SPHERICAL SYMMETRY [LOESUNG DER STATIONAERENNEUTRONENTRANSPORTGLEICHUNG BEI KUGELSYMMETRIE]
W. Hanke, E. Horlitz, and W. Petry Dec. 1969 26 p refs In GERMAN
(JUL-634-MA) Avail: CFSTI

The development of a pebble bed reactor at Juelich (Germany) necessitated the mathematical solution of the general stationary neutron transport equation. This equation was treated for the spherical symmetry case, because of the reactor type, along with the boundary condition that the neutron flux into the reactor was zero, and was transformed into a Fredholm integral equation of second order. The existence and uniqueness theorems, and the iteration methods are described. The discrete problem for the case of downward scattering is discussed and several examples are presented. ESRO

N70-28980# Los Alamos Scientific Lab., N.Mex.
POLARIZATION MEASUREMENTS OF 16.5-MeV AND 22.1-MeV NEUTRONS ELASTICALLY SCATTERED FROM LIQUID TRITIUM AND LIQUID DEUTERIUM
Roger Kenneth Walter (Ph.D. Thesis—Brigham Young Univ.) 10 Nov 1969 181 p refs
(Contract W-7405-eng-36)
(LA-4334) Avail: CFSTI

The final n-d scattering lengths are given and the experimental bases for the results are described. The difficulty of extracting the s-wave phase shifts at low energies is illustrated, and preliminary error limits at 0.1 and 0.2 MeV are given. Cubic spline data fitting is outlined mathematically and illustrated graphically, and applied to the representation of n-p and n-d total cross sections for energy up to 1 GeV; the n-n difference between the n-d and n-p spline fits is also presented. Tables of the spline representation of the n-d total cross section, the numerical data, and of p-d total cross sections at high energy are provided. The suggestion that there may be undetected fluctuations in the n-p and n-d total cross sections is examined in detail, with negative results. Ninety-three sets of differential cross sections between 0.1 and 2000 MeV are presented in a uniform, computer-generated graphical compilation, using cubic spline fitting. Author (NSA)

N70-28981# Los Alamos Scientific Lab., N.Mex.
ELASTIC CHANNEL IN NEUCLEON-DEUTERON SCATTERING
John D. Seagrave [1969] 118 p refs Presented at the Intern. Conf. on the Three-body Probl. in Nucl. and Particle Phys., Birmingham, Engl., 8-10 Jul. 1969
(Contract W-7405-eng-36)
(LA-DC-10638; CONF-690710-4) Avail: CFSTI

Cryogenic scattering samples of approximately one mole of liquid tritium and liquid deuterium were used in the measurement of T(n,n) and D(n,n)D elastic scattering. The source of 16.5-MeV, −54% polarized neutrons and of 22.1-MeV, +40% polarized neutrons was the T(d,n)He-4 reaction with an incident deuteron energy of 6.0 MeV. The left-right scattering asymmetries for laboratory angles from 40 deg to 118.5 deg were measured with a two-detector, time-of-flight spectrometer; and after neutron-gamma ray discrimination was applied, the pulse height spectra were routed to an on-line computer for preliminary data analysis. The measured asymmetry for T(n,n)T is negative at angles forward of 95 deg (lab) and positive at larger angles. The extrema of the n-T polarizations are −60% at 85 deg and +98% at 110 deg (lab). T(n,n)T polarizations are negative at forward angles. D(n,n)D polarizations are measured to be small and negative at forward angles and small and positive at back angles. Author (NSA)

N70-29048# Missouri Univ., Rolla.
FAST NEUTRON EFFECTS ON TRANSISTOR SCATTERING PARAMETERS
David Leslie Gray (M.S. Thesis) 1969 89 p refs
(Contract AT(11-1)-1624)
(COO-1624-21) Avail: CFSTI

Using the scattering parameter concept, which regards a device as a two-port black box, a full characterization of the trends in the neutron bombarded high-frequency performance of a typical transistor can be made. Methods which exist to permit the rapid design of high-frequency transistor circuits, are reviewed. The effects of neutron bombardment on a high-frequency transistor amplifier are found to be generally enhancing, rather than degrading as expected, if the device is operating near or above the published minimum. Author (NSA)

N70-29079# Princeton-Pennsylvania Accelerator, Princeton, N.J.
STUDIES OF SHORT-LIVED RADIOACTIVE ISOTOPES WITH ON-LINE ISOTOPE SEPARATORS
R. A. Naumann 8 Sep. 1969 64 p refs Presented at the Intern. Conf. on Radioactivity in Nucl. Spectry. Tech. and Appl., Nashville, 11–15 Aug. 1969
(Contract AT(30-1)-2137)
(PPAD-665-E; CONF-690818-10) Avail: CFSTI

Presently a number of laboratories are engaged in the study of the radioisotopes of gaseous or easily volatilized elements. These studies involve gaseous transfer from a target to the ion source of an on-line isotope separator. These projects are reviewed and results are presented for isotopes with half lives in the second range. The extension of the technique to even shorter lived isotopes of a wider group of elements involves isotopes production by bombarding targets which are located within the ion source of the mass separator. NSA

N70-29081# Oak Ridge National Lab., Tenn.
ANALYSIS OF GROUND-STATE ENERGY EIGENFUNCTIONS FOR FINITE DIPOLE IN SPHERICAL COORDINATE SYSTEMS
W. R. Garrett, J. E. Turner, and V. E. Anderson Feb. 1970 51 p ref

(Contract W-7405-eng-26)
(ORNL-4431) Avail: CFSTI

Ground-state-energy eigenfunctions for an electron in the field of a stationary, finite electric dipole are expressed in spherical polar coordinates with the origin taken at (1) the location of the positive dipole charge and (2) the center of the dipole. The mixtures of radial and angular functions are calculated for dipole moments. The functions so expressed can be used in perturbation calculations of the effects of other potentials on the interaction of electrons with polar molecules. They also show the number and relative importance of various partial waves pertinent to low-energy scattering of electrons by polar molecules. The direct numerical solution for the ground state of the electron in the field of a stationary finite dipole is given in spherical polar coordinates. Author (NSA)

N70-29101# Scientific Translation Service, Ann Arbor, Mich.
EXPERIMENTAL INVESTIGATION OF THE PROCESS OF ELECTRON-PHOTON SHOWER GENERATION AT ENERGIES RANGING FROM 20 TO 300 MeV
Z. Ogrzevalskii et al [1969] 15 p refs Transl. into ENGLISH from Russian report JINR-P1-4562 Sponsored by AEC Prepared for ORNL
(ORNL-tr-2257; JINR-P1-4562) Avail: CFSTI

The experimental results concerning fluctuations of average characteristics of the longitudinal and transverse development of the electron-photon showers in the 26-liter xenon bubble chamber are given. The presented data are illustrated. Author (NSA)

N70-29109# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
SPIN INTERACTIONS BETWEEN SLOW ELECTRONS AND AMINO ACID FILMS Progress Report, 1 Mar. 1969 - 28 Feb. 1970
Edward Yeargers 1 Mar. 1970 20 p refs
(Contract AT(40-1)-3799)
(ORO-3799-3; PR-2) Avail: CFSTI

The multiplicities and populations of electronic excited states produced in aromatic amino acids under bombardment by electrons with energies between approximately 0 and 1000 eV were investigated. A three-fold approach was used during the past year: (1) ab initio quantum mechanical calculations were made for a system involving two orbital electrons and an incident electron, (2) semiempirical self-consistent-field calculations of the excited-state pi-electron charge densities of tyrosine were made and, (3) equipment including an electron gun and a UV-visible emission spectrometer was constructed and leak tested, and spectral data for tryptophan at 300 K and 77 K were recorded. Author (NSA)

N70-29130# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Nuclear Science.
NEUTRON SLOWING DOWN IN MIXTURES CONTAINING SCATTERING RESONANCES
Floyd E. Dunn and Martin Becker [1969] 7 p refs Presented at 17th Conf. on Remote Systems Technol., San Francisco, Dec. 1969
(Contract AT(30-3)-328)
(RPI-328-164; CONF-691102-16) Avail: CFSTI

Comparative results are given for the 28.3 keV resonance of iron for binary mixtures of iron and of composite background materials representing the remaining in fast reactors. A new average logarithmic energy decrement relating slowing down density to collision density is defined. The scattering kernel in relation to the Greuling-Goertzel approximation is considered. J.M.C.

N70-29132# Scientific Translation Service, Ann Arbor, Mich.
MECHANISM OF INTERACTION OF HIGH AND ULTRA-HIGH ENERGY PARTICLES WITH ATOMIC NUCLEI. NEW TYPES OF ELEMENTARY PARTICLE INTERACTIONS
V. S. Barashenkov et al [1969] 10 p refs Transl. into ENGLISH from Russian Report JINR-P2-4662; Presented at 11th Intern. Conf. on Cosmic Rays, Budapest, 1969 Sponsored by AEC Prepared for ORNL
(ORNL-tr-2258; JINR-P2-4662) Avail: CFSTI

The mechanism of intranuclear cascades which is in good agreement with the presently available experimental data on inelastic pion- and nucleon-nucleus interactions in the whole energy range from a few dozens of MeV to a few GeV comes in contradiction with them at higher energies ($T > \approx 5$ GeV). To eliminate these disagreements it is necessary to take into account many-particle interactions, production of resonances and changes in the nuclear matter density as the intranuclear cascade develops. The analysis of the experimental data at energies $T > \approx 100$ GeV is a unique possibility for investigating a new type of elementary particle interactions when in the initial state three, four or more particles (multiple particle interactions) rather than two, as is usually the case, are involved in the collision. Author (NSA)

N70-29138# California Univ., Berkeley. Lawrence Radiation Lab.
STUDY OF PION(-) PLUS PROTON YIELDS LAMBDA HYPERON PLUS KAON(0) FROM 944 MeV/c TO 1170 MeV/c
Joseph Cecil Doyle (Ph.D. Thesis) Dec. 1969 63 p refs
(Contract W-7405-eng-48)
(UCRL-18139) Avail: CFSTI

The process pion(-) plus proton yields Lambda hyperon plus Kaon(0) was studied at incident beam momenta of 944, 968, 986, 991, 1006, and 1170 MeV/c in the Lawrence Radiation Laboratory 72-inch hydrogen bubble chamber. Differential and total cross sections and polarizations are presented. An attempted partial-wave analysis incorporating previously reported data at 1030 MeV/c is described and two solutions found are compared with other results. Author (NSA)

N70-29140# Brookhaven National Lab., Upton, N.Y.
[PROGRESS AND TRENDS OF THE RESEARCH PROGRAMS IN PHYSICAL SCIENCES, ENGINEERING, AND LIFE SCIENCES] Annual Report
1969 243 p refs Sponsored by AEC
(BNL-50169) Avail: CFSTI

The progress and trends of the research programs in particle physics, nuclear structure, neutron physics, solid state physics, theoretical physics, high energy accelerators, instrumentation, chemistry, applied science and mathematics, biology, and medical research are summarized. The operational, service, and administrative activities are also briefly outlined. A list of all publications published or submitted during the year is appended. NSA

N70-29145# California Univ., Berkeley. Lawrence Radiation Lab.
ETA' MESON PRODUCTION IN PION(+) DEUTERON INTERACTIONS FROM THRESHOLD TO 2.4 GeV/c
Robert K. Rader Dec. 1969 71 p refs
(Contract W-7405-eng-48)
(UCRL-19431) Avail: CFSTI

Meson production is studied as part of an experiment using a positive pion beam incident on deuterium in the 72-in. bubble chamber, with beam momenta from 1.1 to 2.4 GeV/c. The eta-meson is produced in the reaction positive pion deuteron yields 2 proton eta-meson, and the decay mode eta-meson yields positive pion negative pion eta-meson is observed. The reaction positive pion neutron yields proton eta-meson is studied by using the spectator model. The cross section for positive pion neutron yields proton eta-meson is observed to rise to a maximum of about 100 microbar at 2.2 GeV c.m. energy. The production angular distribution develops peripheral peaking with increasing energy. Author (NSA)

N70-29176# Oak Ridge National Lab., Tenn.
AN EVALUATION AND COMPILATION OF THE FISSION AND CAPTURE CROSS SECTIONS OF PU 239 IN THE ENERGY RANGE 25 keV – 15 MeV
N. M. Greene (Union Carbide Corp., Oak Ridge, Tenn. Computing Technol. Center), J. L. Lucius (Union Carbide Corp., Oak Ridge, Tenn. Computing Technol. Center), and C. W. Craven, Jr. Jan. 1970 48 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2797; ENDF-131) Avail: CFSTI

An evaluation and compilation of the fission and capture cross sections of Pu-239 in the energy range 25 keV to 15 MeV was made. The evaluation was a part of the cooperative effort of the Fissile and Fertile Task Force of the Cross Section Evaluation Working Group to improve and extend the first iterate ENDF/B data. The evaluation was performed by making a weighted least squares fit of the available experimental data. The parameters chosen for the analysis were the ratio of the fission cross section of Pu-239 to that of U-235 and the capture-to-fission ratio (alpha) of Pu-239. The Task Force had previously agreed on a reference set of fission cross sections for U-235. The input data for the fit of the fission ratio included values and experimental uncertainties reported for some 24 experiments. Where this parameter was not directly measured, it was inferred, if possible, from measurements performed in the same experiment for the fission cross sections of Pu-239 and U-235. Author (NSA)

N70-29181# Scientific Translation Service, Ann Arbor, Mich.
ONE MORE POSSIBLE METHOD OF HEAVY ION ACCELERATION [ESCHE ODIN VOZMOZHNYI SPOSOB USKORENIYKH TYAZHELYKH IONOV]
N. I. Terentin [1969] 10 p refs Transl. into ENGLISH from Russian Report JINR-P9-4555 Sponsored by AEC Prepared for ANL
(ANL-Trans-805; JINR-P9-4555) Avail: CFSTI

A method of acceleration of heavy ions in the cyclotron when ions are stripped in the process of acceleration, is suggested. Sufficiently intense and monoenergetic beams of heavy ions of wide set (from argon ions to uranium ions), having the energy of about 10 MeV per nucleon, can be obtained in the cyclotron of relatively moderate dimensions (the final orbit radius being R = 200 cm). Author (NSA)

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N70-27828# ARO, Inc., Arnold Air Force Station, Tenn.
SPECTROSCOPIC DETERMINATION OF TEMPERATURE IN A POTASSIUM-SEEDED AIR PLASMA Final Report, Mar.–Apr. 1968
J. W. Gearhart Arnold Eng. Develop. Center Feb. 1970 45 p refs
(Contract F40600-69-C-0001)
(AD-700982; AEDC-TR-69-216) Avail: CFSTI CSCL 20/9

Spectroscopic measurements of radial electron excitation temperature distributions were made at the exit of a seeded, 2-mw arc heater. A nitrogen-oxygen mixture (about 3:1 in mass flow) was seeded with potassium carbonate. Potassium I lines were used in the determination of temperature by the ratio method. A modification to the ratio method was devised so that two different lines, observed under different conditions, could be correctly employed in the ratio method. The experimentally determined temperature profiles were nearly uniform across the plasma stream but varied in magnitude from run to run. Relative potassium I atom concentrations were nonuniform, but nearly radially symmetric, and exhibited an off-axis peak. Author (TAB)

N70-27854# Academy of Sciences (USSR), Moscow. Institut Fiziki.
SPECTRA OF MAGNETOHYDRODYNAMIC TURBULENT PLASMA
M. A. Livshits and V. N. Taytovich 1969 35 p refs In RUSSIAN *Its* Preprint No. 160
(NP-18110) Avail: AEC Depository Libraries

Steady frequency spectra formed during nonlinear interactions of Alfven and magnetohydrodynamic waves were studied. It was observed that scattering on plasma particles was the principal form of the nonlinear interaction. The conditions of stability of the power-law spectrum were investigated, and it was found that the power-law spectrum was stable at nu > or = to 1. With nu = 1 or 2, the power-law character of the spectra was not disturbed in the process of attaining steady states, in contrast to other values of nu. Author (NSA)

N70-27859# Tennessee Univ., Tullahoma. Space Inst.
INTERNAL MHD CHANNEL FLOWS INCLUDING HALL EFFECT AND VARIABLE FLUID PROPERTIES Final Report
William T. Snyder and James R. Maus Feb. 1970 93 p refs
(Contract F40600-67-C-0001)
(AD-701386; AEDC-TR-70-26) Avail: CFSTI CSCL 20/9

An analysis is presented of MHD channel flow with Hall effect and variable fluid properties. Because of the highly nonlinear nature of the governing conservation equations, a straight numerical analysis of the equations is followed based on the implicit finite difference method. The analysis considers the two-dimensional flow in the electric field plane in which the channel walls are electrode surfaces. Because of the presence of the Hall effect, a transverse pressure gradient is induced in the flow which necessitates the use of two equations of motion in the longitudinal and transverse directions. The analysis model employed is the so-called slender channel model in which the boundary layer forms of the equations of motion are applied across the entire channel width. Because the boundary layer equations are parabolic, it is possible to integrate the equations in a forward marching manner by starting with initially prescribed velocity and enthalpy profiles at the channel entrance. Author (TAB)

N70-27861# United Kingdom Atomic Energy Authority, Culham (England).
PLASMA EQUILIBRIUM AND STABILITY IN CLOSED TRAPS WITHOUT ROTATIONAL TRANSFORM
V. D. Shafranov et al Oct. 1969 4 p Transl. into ENGLISH from I. V. Kurchatov Inst. Preprint No. 18/1616, 16 Jul. 1969 p 1–4
(CTO-691; Rept-18/1616) Avail: AEC Depository Libraries

The critical plasma pressure for equilibrium and stability in closed magnetic traps without rotational transform with variable curvature of the axis was estimated. As was shown earlier by Shafranov and by McNamara, the minimum B in such traps can be set up in the presence of fields due to the second and third harmonics, which are periodic over the length of the trap. NSA

N70-27874# United Kingdom Atomic Energy Authority, Culham (England).
INFLUENCE OF THE NON-EQUIPOTENTIALITY OF THE MAGNETIC SURFACES ON THE TRANSPORT PROCESSES IN STELLARATORS
L. M. Kovrizhnykh Oct. 1969 6 p refs Transl. into ENGLISH from Lebedev Inst. Preprint No. 128, 28 Aug. 1969 p 1–7
(CTO-674; Rept-128) Avail: AEC Depository Libraries

Expressions are given for the particle fluxes across the magnetic field of an l = n stellarator taking into account the departure between equipotential and magnetic surfaces. The values for the corrections to the potential as a function of the plasma parameters are determined from the quasi-neutrality condition and it is shown that in some cases the noncoincidence between the

equipotentials and the magnetic surfaces may be considerable and lead to appreciable changes in the coefficients of diffusion and thermal conductivity. Author (NSA)

N70-27927# Air Force Cambridge Research Labs., Bedford, Mass. Ionospheric Physics Lab.
THE CHARACTERISTICS OF A SPACE-VEHICLE-BORNE CHARGED PARTICLE SENSOR
Michael Smiddy and R. Stuart Nov. 1969 24 p refs *Its* Phys. Sci. Res. Papers No. 400
(AD-701011; AFCRL-69-0519) Avail: CFSTI CSCL 20/9

An expression is developed for the current flow to n spheres with known potential differences between them in a drifting Maxwellian plasma. By equating this to zero and solving the resulting equation numerically, one obtains the potential of the spheres relative to the plasma. A charged particle sensor mounted on a space vehicle is then investigated, represented by a two-sphere system. The current-voltage characteristic produced by sweeping the potential difference between the two spheres is derived and shown to be distorted by the variation of the vehicle potential. A method of correction, that is, by the introduction of a third sphere, is described. The effects of area ratio, temperature, and drift velocity are investigated. An attempt is made to use this method to throw some light on the case where the vehicle is cylindrical. The added complications owing to the attitude sensitivity of the system as soon as any electrode becomes nonspherical are immediately apparent. Finally, the implications of the theory in temperature determination from the sensor characteristic are discussed. Author (TAB)

N70-27954# Joint Publications Research Service, Washington; D.C.
DETECTION AND INVESTIGATION OF STIMULATION EMISSION IN ARGON PINCH DISCHARGE
A. N. Vasileva et al AEC Jan. 1970 38 p refs Transl. into ENGLISH from Russian Rept. NP-71892 and Akad. Nauk SSSR, Inst. Fiz. Preprint No. 184
(AEC-tr-7127; Rept-71892; Rept-184) Avail: CFSTI

Pinch discharges are first discussed, considering experimental installations, electrical characteristics of the discharge, optical measurements, and the mechanism of the pinch-discharge development. The induced emission in pinch-discharge plasma is then considered, taking into account generation in Ar(+) ions of emissions of 4765 and 4880 A, and the intensity of generation as a function of initial predsure in the discharge chamber, the diameter and rate of current increase, the generation appearance moment, and the duration and time characteristics of the pinch discharge. The generation in Ar(2+) of emissions of 3511 and 3638 A, the moment of appearance and the duration of generation, intensity and maximum frequency of induced emission pulses are discussed, as well as preliminary ionization of the gas and the energy of emission. NSA

N70-27975# Minnesota Univ., Minneapolis. Inst. of Technology.
INVESTIGATIONS OF IONIC SPECIES IN HIGH PRESSURE CESIUM DISCHARGES Annual Report, 1 Mar. 1969 – 28 Feb. 1970
L. M. Chanin 28 Feb. 1970 32 p refs
(Contract N00014-67-A-0113-002)
(AD-702077; AR-4) Avail: CFSTI CSCL 20/9

Ionic sampling studies have been performed on cesium plasmas using dc as well as rf excitation. For dc discharges sampling was undertaken through both the anode and cathode. Measurements have been made for normalized pressures from 0.0001 to 0.1 Torr. The major ions observed were cs(+), Cs2(+) and Cs3(+). For a fixed cesium pressure, I(Cs2(+)/I(Cs(+)) and I(Cs3(+))/(Cs(+)) in general, decreased with increasing values of the total ion signal. At low pressure about 0.0001 Torr Cs(+) was dominant, however about 0.1 Torr the ion signals of Cs2(+) were comparable to those of Cs(+). The ion current signals of Cs3(+), increase rapidly with cesium pressure. Author (TAB)

N70-28040*# Oklahoma State Univ., Stillwater.
THEORY, DESIGN, AND PERFORMANCE OF A COAXIAL EXPLODING-WIRE SYSTEM
Jerry Allen Yoder (M.S. Thesis) May 1970 107 p refs
(Contracts NASr-7; NAS8-21391)
(NASA-CR-102687) Avail: CFSTI CSCL 20I

A coaxial cable, exploding wire system was designed and constructed with pressurized spark gaps as switches. A square voltage pulse of known amplitude and duration was used to explode a small diameter, aluminum wire, which was mounted in a vacuum and connected as the termination of a coaxial cable, delay line. The energy content of the plasma from the wire was determined by measuring only the voltage across the plasma as a function of time. The energy of the voltage pulse, which was reflected by the wire termination, was diverted and dissipated so that the wire exploded in a field free region. The diffusion equation for the skin effect was also investigated to determine the uniformity of the current and energy density generated in a small diameter wire. Author

N70-28072# Oak Ridge National Lab., Tenn.
HIGH FREQUENCY FLUTE-LIKE INSTABILITIES IN MULTI-COMPONENT PLASMAS
G. E. Guest, W. M. Farr, and R. A. Dory 8 Dec. 1969 13 p refs
(PB-188662; ORNL-TM-2798) Avail: CFSTI CSCL 20I

Plasmas confined in magnetic mirror traps often consist of mixtures of energetic non-Maxwellian particles and colder Maxwellian particles of the same species. If the total distribution of particles in perpendicular speed is nonmonotonic, electrostatic waves at gyroharmonic frequencies propagating perpendicular to the magnetic field may be unstable. Here we obtain necessary conditions for stability of these waves in a spatially homogeneous model of mirror-confined plasmas and relate these conditions to wave propagation properties of the plasma. The necessary conditions for stability are displayed as stability boundaries in the space of relative density and relative average energy of the hot and cold components. Author (USGRDR)

N70-28078# Joint Publications Research Service, Washington, D.C.
RESEARCH IN MAGNETOHYDRODYNAMICS SUMMARIZED
Andrei Nicolaide *In* Transl. on Eastern Europe Sci. Affairs, No. 102 4 Mar. 1970 p 9 – 11 Transl. into ENGLISH from Scinteia (Bucharest), 14 Jan. 1970 p 6 (See N70-28077 14-34)
Avail: CFSTI

Magnetohydrodynamic pumps and generator concepts are briefly discussed, as well as research in the theoretical and practical development of MHD pumps and flowmeters. S.S.

N70-28112*# Boeing Co., Seattle, Wash.
PLASMA REACTOR DEVELOPMENT FOR METHANE DECOMPOSITION TO ACETYLENE AND HYDROGEN
Robert K. Ames 1970 50 p
(Contract NAS1-8254)
(NASA-CR-66905) Avail: CFSTI CSCL 20I

Experimental apparatus was constructed to study high temperature decomposition of methane to acetylene and hydrogen. Data was obtained on Sabatier reactor performance, and anode designs were tested. Energy distributions in a plasma reactor were measured for various anode configurations and cathode-anode spacings. Conclusions were drawn on efficiencies of small hydrogen plasma reactors. Author

N70-28223# Innsbruck Univ. (Austria). Inst. for Theoretical Physics.
INVESTIGATIONS ON PLASMA INSTABILITIES AND ON MHD APPLICATIONS Final Report, 1967 – 1969
Ferdinand Cap, Gerhard Auer, Helmut Bresgen, Helmut Faber, Dietmar Floriani et al 31 Dec. 1969 152 p refs

(Contract F61052-67-C-0014)
(AD-701453; UNICP-FR69; AFOSR-70-0387TR) Avail: CFSTI CSCL 20/9

The report describes theoretical investigations on plasma instabilities appearing in dynamic equilibrium configurations of thermonuclear power and propulsion devices. Zeroth order diffusion velocities due to the geometry of the confining magnetic field and due to the transport properties of the plasma variable in space and time, and the finiteness of these devices introduces new types of instabilities of nonlinear nature. Therefore the nonlinear development of nonperiodic large amplitude disturbances of the field quantities has been investigated for nearly collisionless, collision dominated and magnetohydrodynamic plasmas. The report gives summaries on Helmholtz instabilities, on instabilities in dissipative plasmas, on applying Lyapunovs theory to stability problems in plasma physics, on drift waves, and on micro-instabilities in arbitrary geometrical configurations. Furthermore summaries on the local efficiency of MHD generators and on similarity transformations in magnetogasdynamics are given. Author (TAB)

N70-28240*# Maryland Univ., College Park. Dept. of Physics and Astronomy.
EXPERIMENTAL AND THEORETICAL INVESTIGATION OF PLASMA RADIATION Semiannual Status Report, Sep. 1969 - Feb. 1970
Hans R. Griem and J. R. Greig Feb. 1970 6 p refs
(Contract NGR-21-002-073)
(NASA-CR-110002) Avail: CFSTI CSCL 20I

The measurement of the Stark broadening for the resonance lines of neutral argon and neon is reported. Experimental values for wf, the product of the Stark broadening parameter and the oscillator strength for each line, and the values of w derived from this quantity using the most recently measured values of f, the oscillator strength for each line are tabulated. The plasma conditions for the electromagnetically driven T-tube source used in these determinations are also summarized. Values of the electron temperature obtained from the visible lines emitted by the source and those obtained from the fitted profiles of the saturated emission lines in the vacuum ultraviolet agreed to within 3%. Thus these saturated UV lines under our T-tube conditions could serve as an intensity standard in this region of the radiation spectrum. Author

N70-28303 Colorado Univ., Boulder.
PLASMA ELECTRICAL CONDUCTIVITY IN A MAGNETIC FIELD FROM HALL EFFECT AND FROM SOLENOIDAL ELECTRIC FIELD INTERACTION
Donald Joseph Albares (Ph.D. Thesis) 1969 107 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 69-19517

Quantities inferred for the first time using these methods were the electron-ion momentum transfer collision frequency, ion mobility in the magnetic field, and the combinations of these two with the electron-atom momentum transfer collision frequency. The objective was to study these quantitatively at low frequency under conditions of improved symmetry, control, and stability. When a term borrowed from simple theory to account for ion mobility in the magnetic field becomes dominant, the resulting ion mobility is 75% larger than the He(+) mobility in helium taken from drift tube measurements. This disagreement suggests that further theoretical work on ion mobility in a plasma in a magnetic field is needed. Dissert. Abstr.

N70-28311# Florida Atlantic Univ., Boca Raton. Dept. of Physics.
CYCLOTRON WAVE TRANSMISSION ACROSS A PLASMA
B. N. A. Lamborn Jun. 1969 4 p refs
(Grant AF-AFOSR-1298-67)
(AD-701598; AFOSR-70-0506TR) Avail: CFSTI CSCL 20/9

The relativistic Vlasov dispersion relation is used to find the critical density below which the extraordinary wave can propagate freely across a mirror-field plasma into the cyclotron-resonance region. Author (TAB)

N70-28417# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.
TO THE ECHO THEORY IN PLASMA OF THE THREE-MOMENTA ECHO VIBRATIONS
A. G. Sitenko, Nguyen Van Trong, and V. N. Pavlenko 1969 15 p refs In RUSSIAN
(ITF-69-73) Avail: AEC Depository Libraries

A consideration is made of the echo vibrations in plasma arising due to superposition of three successive perturbations divided in time by the intervals, large as compared with the characteristic time of damping of the vibrations. Perturbations are chosen in the form of plane waves with the wave vectors of perturbations being assumed colinear one to another, therefore echo vibrations of the second order are impossible. The possibility of echo vibrations of the third order is shown, if the wave vectors of perturbations lie in one plane. The origin time and the form of echo vibrations of the second order are found. It is shown that, even in the case of longitudinal perturbations, the field of echo vibrations involves both the longitudinal and cross components. A number of examples of the origination of echo vibrations of the third order are considered. Author (NSA)

N70-28424# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.
ECHO THEORY IN PLASMA SPATIAL ECHO IN PLASMA
A. G. Sitenko, Nguyen Van Trong, and V. N. Pavlenko 1969 12 p refs In RUSSIAN
(ITF-69-84) Avail: AEC Depository Libraries

A consideration is made of the spacial echo effects in plasma which arise as a result of interaction of external perturbations applied in various places of space. There have been considered spacial echo vibrations connected with the transformation of waves in plasma, spacial echo vibrations conditioned by the distribution function perturbations and spacial echo vibrations in nonequilibrium plasma. Author (NSA)

N70-28452# Electro-Optical Systems, Inc., Pasadena, Calif.
X-ATRON DIAGNOSTIC Final Technical Report, 1 Jun. 1967 - 29 Aug. 1969
G. L. Cann, R. O. Harder, C. B. Shepard, Jr., and P. F. Jacobs Sep. 1969 280 p refs
(Contract F33615-67-C-1913)
(AD-701734; EOS-7239-F; ARL-69-0150) Avail: CFSTI CSCL 20/9

Electromagnetically confined plasma was investigated in X-atron devices. Plasma generated by arc discharges between on-axis cathodes and ring anodes was contained by axially symmetric magnetic fields. Hydrogen plasma forms a virtual cathode along the axis and lithium plasma forms an anode sheath along the magnetic flux tube through the concentric ring mode. X-atron I, with electrodes at one end, operated with potential drops over 400 volts. These potentials increased with arc current and magnetic field strength, as predicted, and inversely with mass flow rate, but did not follow the theoretical quadratic law. X-atron II, with electrodes at each end of a symmetrically-bucking magnetic field, was designed to more completely confine the arc discharges. A multi-ring plasma isolator was positioned at the magnetic mid-plane for potential isolation, particle collection and diagnostic measurements. Operation at low tank pressures and low lithium flow rate was characterized by high voltages, and copious electronic noise. The plasma was stably confined by the magnetic field when sufficient lithium was injected to permit total current conduction by lithium ions across magnetic field lines from the anode sheath by the virtual cathode. This low-pressure, high lithium-feed mode confirms postulated mechanisms. Author (TAB)

N70-28469 California Univ., San Diego.
ENERGY TRANSFER IN A HIGHLY IONIZED PLASMA INCLUDING COLLECTIVE AND NON-MAXWELLIAN EFFECTS
Ely Simon Levinski (Ph.D. Thesis) 1969 111 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 69-19443

The transfer of energy in a fully ionized Lorentz gas is first studied by considering the emission and absorption of longitudinal plasma waves between regions of the gas with near Maxwellian electron distribution functions at different local tempratures. These waves are both collision and Landau damped, the latter type of damping affecting energy transport only secondarily. The thermal conductivity is found to agree with two-body collision treatments in the infinite Landau damping limit. Sample calculations of thermal conductivity are made for modified Druyvesteyn-type electron distribution functions produced with an applied electric field. Nonlinear effects arising from the electric field induced by a temperature gradient are evaluated. Dissert. Abstr.

N70-28528# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
PLASMA EXPANSION CHAMBER IN AN ION SOURCE OF THE DUOPLASMATRON TYPE
L. Bex, J. Faure, and R. Vienet [1969] 3 p In FRENCH Presented at the Intern. Conf. on Ion Sources, Saclay, France
(CEA-CONF-1384; CONF-690825-5) Avail: AEC Depository Libraries

The radial density, the intensity, and the emittance of a beam of protons from a duoplasmatron-type source were studied using an expansion chamber which is isolated so as to polarize it at the electric potential required with respect to the anode potential. The walls were without deposits and were perfectly conducting. The effect of the leak magnetic field and the length of the expansion chamber were studied. The data obtained are tabulated. NSA

N70-28547# Akademiya Nauk URSR, Kharkov. Fiziko-Tekhnicheskii Inst.
COLLECTIVE INTERACTIONS AND PLASMA HEATING IN HIGH-CURRENT GAS DISCHARGE
V. A. Suprunenko, E. A. Sukhomlin, and V. T. Tolok 1969 15 p refs In RUSSIAN
(KHFTI-69-30) Avail: AEC Depository Libraries

Processes inducing kinetic instabilities and heating of dense plasma placed in a strong electric field were studied. Data obtained showed that effective heating of electron and ion plasma components took place in a high current gas discharge during the development of high frequency instabilities accompanied by anomalous plasma resistance and intense microwave emission. Results are discussed and the possibility of finding the mechanism inducing the instabilities was analyzed. Author (NSA)

N70-28548# Democritus Nuclear Research Center, Athens (Greece).
SYSTEM ANALYSIS AND SIMULATION IN MAGNETOHYDRODYNAMICS
J. Kontos May 1969 60 p refs
(DEMO-69/2) Avail: AEC Depository Libraries

Engineering system analysis and simulation methods are applied to problems in magnetohydrodynamics (MHD). These methods are used for description, analysis, and computation. The main areas in MHD to which the present approach could be applied are reviewed. It is shown how the behavior of vacuum-plasma interfaces can be visualized in terms of field impedances, equivalent networks, and closed-loop systems. Next, these general ideas are applied to some particular cases with infinite conductivity. Two cases with finite conductivity are considered and analog computation is used for their solution. Some attempts to make some progress with a nonlinear case are described briefly. Conclusions and suggestions for further work are given. NSA

N70-28553# Akademiya Nauk URSR, Kharkov. Fiziko-Tekhnicheskii Inst.
COLLECTIVE INTERACTIONS IN LOW-DENSITY PLASMA WITH HIGH-CURRENT GAS DISCHARGE
M. M. M. Masud, M. E. Maznichenko, N. I. Reva, V. A. Suprunenko, E. A. Sukhomlin et al 1969 8 p refs In RUSSIAN
(KHFTI-69-31) Avail: AEC Depository Libraries

Experimental studies were made of instabilities appearing in electrode discharge during its initial stages, when the degree of ionization of the working gas was small and the plasma density was low. It is shown that the collective process is similar to the interactions during external electron beam injection into plasma and differs considerably from the processes developing in dense highly ionized plasma in high electric fields. Data obtained indicate that the collective processes can substantially influence the mechanism of breakdown of neutral gas. Author (NSA)

N70-28557# Akademiya Nauk SSSR, Novosibirsk. Inst. Yadernoi Fiziki.
MEASUREMENT OF THE ELECTRON TEMPERATURE OF A PLASMA USING A DIFFERENTIAL ANALYZER OF CHARGED PARTICLES ACCORDING TO ENERGY [IZMERENIYE ELEKTRONNOY TEMPERATURY PLAZMY PRI POMOSHCHI DIFFERENTSIALNOGO ANALIZATORA ZARYAZHENNYKH CHASTITS PO ENERGII]
N. I. Alinovskii, Yu. E. Nesterikhin, and A. I. Pogozin 1968 31 p refs In RUSSIAN *Its* Preprint No. 260
(NP-18115) Avail: AEC Depository Libraries

The design of a differential analyzer of electrons according to energy is described, and the basis of the method of measuring electron temperature in a plasma through the use of this device is given. The possibility of a distortion introduced by the measuring process into the energy spectrum of the electrons is analyzed. The electron temperature T sub e of a plasmoid generated by a conical induction source was measured to show that the method described yields correct information despite its contact nature. The maximum values of T sub e achieved were of the order of 150 to 250 eV. The slight preionization does not make any noticeable increase in electron temperature but only raises the density and the total number of particles in the plasmoid. The controlling magnetic field produces mainly an increase in the directed energy of the plasmoid. NSA

N70-28578# Academy of Sciences (USSR), Moscow. Inst. of Physics.
EXCITATION OF SURFACE WAVE ON NON-HOMOGENEOUS PLASMA FLUX. STUDIES OF ANOMALOUS PLASMA HEATING UNDER THE INFLUENCE OF SURFACE WAVE FIELDS
K. F. Sergeichev 1969 29 p refs In RUSSIAN *Its* Preprint no. 146
(NP-18118) Avail: AEC Depository Libraries

Anomalous decay of inhomogeneous current in a collisionless plasma was studied. It was observed that the disturbance of the boundary symmetry excited a surface dipole wave propagating along the boundary of a plasma of high negative dielectric penetrability, which was capable of increasing significantly the intensity of the ultrahigh-frequency field inside the plasma. It was also found that the surface wave in the case examined did not play an important part in plasma heating. The absence of anomalous heating processes in dense layers of injected current, in which the surface wave field is localized, was established. The relationship between plasma decay and the fast wave and its polarization in external fields was also found. Author (NSA)

N70-28586# Akademiya Nauk URSR, Kharkov. Fiziko-Teknicheskii Inst.
BEHAVIOR OF OHMIC-HEATED PLASMA IN A LARGE-"LATITUDE" STELLARATOR "URAGAN"

V. N. Vishnevetskii, E. D. Volkov, A. G. Dikii et al. 1969. 20 p refs In RUSSIAN
(KHFTI-69-43) Avail: AEC Depository Libraries

The influence of latitude on the particle and energy loss rate was studied in the stellarator Uragan, using a closed magnetic trap. NSA

N70-28587# Akademiya Nauk URSR, Kharkov. Fiziko-Tekhnicheskii Inst.
THERMOISOLATION AND CONFINEMENT OF PLASMA IN THE "SIRIUS" STELLARATOR
P. Ya. Burchenko, B. T. Vasilenko, E. D. Volkov, V. A. Rudakov, and V. T. Tolok. 1969. 8 p refs In RUSSIAN
(KHFTI-69-47) Avail: AEC Depository Libraries

Previous studies of particle and energy confinement in closed magnetic traps showed that plasma losses exceeded, by several orders, the values assumed in classical diffusion and thermal conductivity. Theoretical data indicated that, in toroidal geometry, abnormally high rates of losses at small frequency of collisions can be determined, as well as Coulomb collisions. Particle and energy confinement for ohmic-heated plasma in the Sirius stellerator are reported here. The studies were confined, mainly to the basic processes responsible for the abnormally high transport coefficients of closed traps. NSA

N70-28597# Joint Publications Research Service, Washington, D.C.
PLASMA RADIATION PROCESS IN ASTROPHYSICS
S. A. Kaplan et al. AEC Jul. 1969. 91 p refs Transl. into ENGLISH of Akad. Nauk SSSR. Inst. Fiz. Preprint No. 65, Rept. No. NP-17701
(AEC-tr-7074; NP-17701) Avail: CFSTI

The theory of plasma radiation mechanisms and classification of plasma mechanisms by emission frequencies are treated. Various aspects of the conversion of plasma waves into electromagnetic waves during: scattering on thermal ions and electrons in isotropic plasma; scattering on epithermal nonrelativistic ions and relativistic electrons; Compton scattering; nonlinear scattering on relativistic ions; and scattering on epithermal and relativistic ions are discussed. Plasma radio-emission mechanisms in radioastronomy is also included. NSA

N70-28654# Nagoya Univ. (Japan). Inst. of Plasma Physics.
ENGINEERING DEVELOPMENTS IN QP EXPERIMENTS
Kiyokata Matsuura, Genichi Horikoshi, Tsutomu Kuroda, Taruyuki Sato, Isao Mizuno et al. Oct. 1969. 19 p. refs Presented at 5th Symp. on Fusion Technol., Oxford, 2-5 Jul. 1968
(IPPJ-T-1) Avail: CFSTI

In the QP machine, a PIG plasma source of high discharge power (up to 100A/500V) with an electron bombardment cathode was constructed to produce hydrogen plasma with high density. The discharge current was determined by cathode temperature and the emissivity of cathode materials. An attempt was made to control the discharge current by feeding it back to the electron bombardment power. A plasma column with a sharp boundary and uniform radial density distribution was developed using an electron bombardment Ta cathode of uniform electron emissivity. To cancel out the temperature rise at the center, a cathode with a material of slightly lower emissivity and welded at the center was also developed. A variable frequency 50 kW rf power oscillator for ion cyclotron resonance heating experiments was constructed. Besides the oscillator tube (NEC 8T72A), another tube of the same type was connected in series in an anode circuit to keep output power level constant. A Faraday shield was inserted inside the heating coil of Stix type to reduce the nonresonant coupling between coil and plasma. To match the inductance of the heating coil, a feeder system of coaxial type including a vacuum variable condenser was constructed. Author

N70-28656# Nagoya Univ. (Japan). Inst. of Plasma Physics.
ENERGY DISPERSION OF POSITIVE IONS EFFUSED FROM AN RF PLASMA
Yukio Okamoto and Hajime Tamagawa. Mar. 1970. 19 p refs
(IPPJ-87) Avail: CFSTI

The energy dispersion for a study of the sheath formation and the ion extraction in an RF plasma are measured by extracting the positive ions through a small hole in a metal plane probe and subjecting them to an electrostatic energy analyzer and a quadrupole mass filter. The energy dispersion of positive ions effused from an RF plasma, change in E, under the assumption that the ion velocity is modulated by a time variation of plasma potential, is calculated theoretically. The theoretical results agree well with experimental findings. Author

N70-28711# Oak Ridge National Lab., Tenn. Technical Information Div.
THERMONUCLEAR FUTURE OF MAGNETIC CONFIGURATIONS OF THE TOKAMAK TYPE
P. Hubert [1969] 11 p refs Transl. into ENGLISH from Nucl. Fusion (Vienna), no. 9, 1969 p 209-214
(ORNL-tr-2282) Avail: CFSTI

Extrapolation of the Tokamak series to a thermonuclear reactor is discussed. The magnetic configurations of the Tokamak type presently rank among the most attractive for the confinement of a thermonuclear plasma. Advantages are as follows: (1) closed configuration, (2) symmetry of revolution, (3) absence of immersed conductors in the plasma, and (4) no theoretical reason for rejection because of lack of equilibrium stability. The principle of Tokamak involves a current induced in the plasma so that it is impossible to conceive of a continuous operation, however, it is shown that a pseudo-steady-state system can be considered for a sufficiently long time that considerations of steady-state operation may be applicable to it. Author (NSA)

N70-28731# Academy of Sciences (USSR), Moscow. Inst. of Physics.
HYDRODYNAMICS OF PLASMA IN A STRONG HIGH-FREQUENCY FIELD
L. M. Gorbunov. 1969. 80 p. refs In RUSSIAN *Its* Preprint No. 174
(NP-18119) Avail: AEC Depository Libraries

Equations obtained for plasma hydrodynamics in strong hf fields and the cases in which these equations can be simplified are discussed in the first part of this review. Properties of small perturbations in plasma with propagating strong electromagnetic waves of assigned amplitude (the inflated wave) and, in particular, studies of paramagnetic resonance and so-called dissipative instabilities are covered in the second part. The problems on plasma equilibrium and plasma dynamics in high-frequency fields are discussed in the third and fourth parts of the review. 140 references. NSA

N70-28743# Akademiya Nauk URSR, Kharkov. Fiziko-Tekhnicheski Inst.
COLLECTIVE INTERACTIONS IN A FAST THETATRON
T. A. El'Khalafavi, V. A. Suprunenko, A. M. Ternopol, L. Khafiz, A. M. Yusef et al. 1969. 18 p refs In RUSSIAN
(KHFTI-69-32) Avail: AEC Depository Libraries

Studies of collective processes in a discharge theta-pinch plasma showed that the kinetic instability in plasma is excited at the expense of anisotropy of electron energy distribution appearing during electron acceleration by the azimuthal electric field of the discharge. A nonadiabatic induction acceleration without producing a steady orbit proved to be the highly probable mechanism of electron acceleration. An epithermal microwave plasma emission consisting of a series of cyclotron harmonics, distributed below the plasma frequency, was observed. At high amplitudes of these oscillations the plasma electron energy slowly became isotropic. The

intensity of microwave emission from plasma increased by the order of two, in the case in which the frequency of higher cyclotron harmonics coincided with plasma frequencies. The maximum radiation was found in the direction forming a sharp angle with the direction of the magnetic field. The radiation was polarized so that the vector of the electric field waves were perpendicular to the external magnetic field. Author (NSA)

N70-28768# Nagoya Univ. (Japan). Inst. of Plasma Physics.
MAGNETIC SURFACES AND DRIFT SURFACES OF AVERAGE MINIMUM B STELLARATOR FIELD
Kenro Miyamoto Mar. 1970 33 p refs
(IPPJ-88) Avail: CFSTI

Dependencies of the well depth, rotational transform angle and shear on the geometrical parameters and current magnitudes of the current configurations and the possible ranges of the value of quantities of the magnetic field are studied and these results are compared with computed ones. The deviation of the drift surfaces of untrapped particles from the magnetic surfaces is studied and it is derived that the deviation is approximately equal to the deformation of the magnetic surface due to the application of an equivalent vertical field. A condition of Larmor radius of ion and the rotational transform angle is obtained for the small deviation of the drift surface from the magnetic one. The effects of geometrical errors of the current configurations on the magnetic surface are analyzed numerically and a tolerable amount of the error is deduced. Author

N70-28771 Stevens Inst. of Tech., Hoboken, N.J.
A STUDY OF THE INTERACTION OF ELECTROSTATIC AND ELECTROMAGNETIC WAVES WITH THE LOSS-CONE PARTICLE DISTRIBUTION TRAPPED WITHIN THE EARTH'S MAGNETOSPHERE
Harvey Harold Bird (Ph.D. Thesis) 1969 99 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 69-21283

The interaction is initially studied of longitudinal waves (propagating at an angle to a uniform magnetic field) with a loss-cone plasma of relativistic electrons moving against a fixed neutralizing ion background. By means of a Nyquist analysis of the dispersion relation, it is found that electrostatic oscillations whose growth rates significantly exceed the electron cyclotron frequency cannot exist. If, however, the ions are free to move, such as is the case for the charged particle population residing within the earth's magnetosphere, then the plasma can support electrostatic oscillations whose growth rates significantly exceed the electron cycloton frequency. It is reasoned that these growth rates must depend in an essential way on the ion plasma frequency, and hence increase with increasing particle density. The actual particle distribution observed within the magnetosphere is then considered, and the results of numerical computations of damping rates are presented. Dissert. Abstr.

N70-28783# Princeton Univ., N.J. Plasma Physics Lab.
PLASMA CONFINEMENT IN A LINEAR QUADRUPOLE
R. W. Palladino Feb. 1970 21 p refs
(Contract AT(30-1)-1238)
(MATT-734) Avail: CFSTI

As a result of experiments with hot electron plasmas in the linear quadrupole device LM-1, several new methods have been derived for evaluating the lifetime of the whole plasma column. In particular, an effort has been made to hold all other important parameters constant and to study the dependence of total plasma lifetime on B (the magnetic field intensity) alone. The various methods seem to converge on plasma lifetimes which have a rather weak magnetic field dependence; in most cases not exceeding a B(1/2) law when the behavior is averaged up to 60 kA in each quadrupole conductor, the upper limit in LM-1 operations. Superimposed on the generally weak B dependence is a very pronounced periodic component (of unknown origin, but suggestive of resonance effects involving the whole plasma column). In view of the rather complex B dependence of the plasma containment it is a little misleading to speak of Bohm diffusion in LM-1, even allowing for the averaging along a flux line that must be done to determine an effective B. Unless the plasma temperature has an equally complex B dependence, even late in the decay when it has dropped well below 1 eV, it would appear that LM-1 containment times do not reflect the B/T relation so familiar from stellarator studies. Author (NSA)

N70-28812*# Scientific Translation Service, Santa Barbara, Calif.
CALCULATION OF THE STATE OF ARGON BEHIND AN INCIDENT SHOCK WAVE BETWEEN MACH NUMBERS 20-50 WITH ALLOWANCE FOR EXCITATION, MULTIPLE IONIZATION, AND COULOMB INTERACTION [RASCHET SOSTOYANIYA ARGONA ZA PADAYUSCHEY UDARNOY VOLNOY V DIAPAZONE CHISEL MAKHA OT DO 50 S UCHETOM BOZBUZHDENIYA, MNOGOKRATNOY IONIZATSII I KULONOVSKOGO VZAIMODEYSTVIYA]
G. N. Kozlov et al Washington NASA Jun. 1970 8 p refs Transl. into ENGLISH from Zh. Prik. Mekhan. i Tekhn. Fiz. (Moscow), no. 3, 1968 p 94-97
(Contract NASw-2035)
(NASA-TT-F-13082) Avail: CFSTI CSCL 20I

The shock wave calculations were performed on an electronic computer. An infinite shock wave was assumed. Various thermodynamic functions are calculated for a set of assumptions. Author

N70-29012# Florida Univ., Gainesville. Dept. of Nuclear Engineering Sciences.
DEVELOPMENT OF PLASMA DIAGNOSTIC METHODS APPLICABLE TO DIRECT ENERGY CONVERSION. SUMMARY Final Technical Report
Richard T. Schneider 1 Jan. 1970 29 p refs
(Contract Nonr-580(19))
(AD-702405) Avail: CFSTI CSCL 20/9

Contents: Time resolved diagnostics of a pulsed low pressure discharge; Pulsed electrodeless discharge in hydrogen; and a new approach for detecting of low photon fluxes in scattering experiments. TAB

N70-29080# Princeton Univ., N.J. Plasma Physics Lab.
STELLARATOR AS A NONLINEAR PLASMA CURRENT TRANSFORMER
H. P. Furth Feb. 1970 11 p refs
(Contract AT(30-1)-1238)
(MATT-759) Avail: CFSTI

The use of a stellarator as a nonlinear plasma current transformer is discussed. Oscillation of the helical winding current of a stellarator induces toroidal plasma currents proportional to the square of the winding current. Where the helical current of an initial stellarator magnetic field configuration, embedded in perfectly conducting plasma, is turned off the consequences are: (1) the pressure balance forces the plasma and magnetic surfaces toward axisymmetry and (2) induced currents spring up in the plasma volume of just the right magnitude to provide the appropriate poloidal magnetic field that will preserve the rotational transform on each magnetic surface. Author (NSA)

N70-29114# Groupe de Recherches Ionospheriques, Paris (France).
[IMPEDANCE MEASUREMENTS OF QUADRUPOLE PROBES]
1970 15 p refs In FRENCH and ENGLISH
(GRI/TP-96; GRI/TP-97) Avail: CFSTI

CONTENTS:
1. EXCITATION AND MEASUREMENT OF THE LOWER

HYBRID RESONANCE BY MEANS OF A ROCKET-BORNE QUADRUPOLE PROBE C. Beghin 7 p refs (See N70-29115 14-13)

2. MEASUREMENTS OF THE TRANSFER IMPEDANCE OF A QUADRUPOLE PROBE AT HIGH FREQUENCIES C. Renard and R. Debrie 7 p refs (See N70-29116 14-25)

N70-29116# Groupe de Recherches Ionospheriques, Paris (France).

MEASUREMENTS OF THE TRANSFER IMPEDANCE OF A QUADRUPOLE PROBE AT HIGH FREQUENCIES

Claude Renard and Roland Debrie *In its* Impedance Measurements of Quadrupole Probes 1970 7 p refs In FRENCH and ENGLISH (See N70-29114 14-25)

Avail: CFSTI

The transfer impedance at high frequencies of a quadrupole probe immersed in a hot magnetoplasma were measured. The observed impedance exhibited a maximum at the upper hybrid frequency of the medium, as predicted by the theory of the probe in a cold magnetoplasma. However, this theory does not explain how the measured transfer impedance depends on the Debye length and on the radius of gyration of the electrons in the medium. Author (ESRO)

N70-29182# Los Alamos Scientific Lab., N. Mex.

LASL CONTROLLED THERMONUCLEAR RESEARCH PROGRAM Annual Status Report, Period Ending Oct. 1969

6 Feb. 1970 109 p refs

(Contract W-7405-eng-36)

(LA-4351) Avail: CFSTI

Recent developmental studies on z- and theta-pinch devices are reported. The studies deal mainly with stabilization and diagnostic techniques. The development of associated equipment is also reported. NSA

N70-29195# Colorado State Univ., Fort Collins. Dept. of Mechanical Engineering.

INVESTIGATIONS ON THE FORMATION AND PROPAGATION OF THE PLASMA IN MHD CHANNEL FLOWS Annual Technical Report, 1 Jan. - 31 Dec. 1969

Horst E. Wilhelm 26 Jan. 1970 137 p refs

(Contract N00014-67-A-0299-0008)

(AD-700927; ATR-1) Avail: CFSTI CSCL 20/9

The report contains specific investigations relevant to technical plasmas, in particular plasmas in energy conversion systems: A kinetic theory of subsonic and supersonic transport processes is given for weakly ionized and fully ionized plasmas. Subsonic and supersonic transport processes are discussed by means of typical examples (current transport in strong electric fields, thermal nonequilibrium in strong electric fields, test particle problem). Analytical solutions are established for the boundary-value problem of the convection and diffusion of temperature and particle distributions in gaseous flows, and for the nonlinear Helmholtz equation describing the ionization-recombination kinetics with diffusion. A perturbation theoretical solution is derived for the nonlinear space charge problem of a plane plasma capacitor in a strong electric field, and an analytical model is developed for the nonlinear space charge oscillations excited by application of a strong voltage pulse. A preliminary account on the problem of ionization of excited atoms by turbulent electric fields in plasmas and the magnetohydrodynamic turbulence in presence of a strong magnetic field is presented. Author (TAB)

N70-29197# Royal Aircraft Establishment, Farnborough (England).

THE JETS OF VAPOURISED ELECTRODE MATERIAL PRODUCED BY A SHORT DURATION HIGH CURRENT ELECTRIC DISCHARGE [STRUI PAROV MATERIALOV ELEKTRODOV PRI KRATKOVREMENNOM ELEKTRICHESKOM RAZRYADE S BOLSHOI SILOI TOKA]

Vladimar Hermoch Jan. 1970 17 p refs Transl. into ENGLISH from Czech. J. Phys. (Prague), no. 9, 1959 p 221-228

(RAE-Lib-Trans-1396) Avail: CFSTI

The jet velocity of vapor emitted from electrodes and the electric field in the discharge channel were measured. An explanation is given of the rate dependence of vapor emission on the electrode material, and the thermal origin of the jets is confirmed. The validity of the results is demonstrated for a different experimental arrangement and the formation of other types of discharges on the electrodes. Author

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N70-27836# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.

LIGHT ABSORPTION BY MOLECULAR CRYSTALS

B. M. Nitsovich 4 Nov. 1969 14 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 14, no. 6, 1969 p 1013-1018

(Contract NOw-62-0604-c)

(AD-700420; APL-CLB-3-T-611) Avail: CFSTI CSCL 20/12

The influence of exciton-phonon interaction on the shape of the light absorption band is studied by the method of retarded Greens functions. The specific choice made of the exciton-phonon interaction model makes it possible to obtain finite expressions for the mass operator of the excitons in the case of small exciton densities and weak exciton-phonon coupling. A quantitative investigation is made of the absorption band taking into account the interaction of an exciton of positive effective mass with phonons of the optical and acoustic branches. The temperature dependence of the absorption bands is investigated. (Author) TAB

N70-27843# Aerospace Corp., El Segundo, Calif. Lab. Operations.

HABIT CHANGES OF SAPPHIRE GROWN FROM PBO-PBF2 AND MOO3-PBF2 FLUXES Technical Report, Jul. 1967 - Apr. 1968

Armond B. Chase and Judith A. Osmer 10 Oct. 1969 25 p refs

(Contract F04701-69-C-0066)

(AD-701376; TR-0066(9230-03)-1; SAMSO-TR-70-10) Avail: CFSTI CSCL 20/2

Single crystals of Al2O3 (sapphire) were grown from both PbO-PbF2 and MoO3-PbF2 fluxes. Their habits varied from flat plates (PbF2-rich melts) to equidimensional crystals (PbO- or MoO3-rich melts). The primary growth planes on these crystals are basal planes (0001), first-order rhombs (10-11), and second-order rhombs (01-12). The habit change is interpreted on the basis of F(1-) crystal contamination and Pb(2+) surface adsorption. Possible ion species in the melt and their relative importance on crystal growth from these melt systems are discussed. Author (TAB)

N70-27917# Vermont Univ., Burlington. Dept. of Electrical Engineering.

ENERGY BAND QUANTIZATION IN HIGH ELECTRIC FIELDS Final Report

Lloyd M. Lambert, Jr. and Robert Koss 1 Oct. 1969 75 p refs

(Grant AF-AFOSR-1157-66)

(AD-700438; AFOSR-69-2790TR) Avail: CFSTI CSCL 20/12

The electric field induced effect upon the optical transmission of semi-insulating gallium arsenide has been measured for photon energies of 1.455 to 1.48 eV. Electric fields up to approximately 100,000 V/cm were applied to two samples, approximately 40

microns in thickness at 85 degrees K and 15 degrees K. The experimental data agrees favorably with the theory of Callaway (Franz-Keldish Effect). The presence of the Wannier Levels, however has not been observed. A technique for fabricating a sample package which is theoretically capable of withstanding electric field strength in excess of 100,000 V/cm is also discussed. Author (TAB)

N70-27921# Michigan Univ., Ann Arbor. Dept. of Electrical Engineering.
VERNEUIL GROWTH EXPERIMENTS WITH MAGNESIUM OXIDE CRYSTALS Final Report, 20 Sep. 1965 – 31 Oct. 1969
H. C. Early, F. J. Martin, and E. A. Martin Oct. 1969 34 p refs
(Contract AF 19(628)-5654)
(AD-700413; AFCRL-69-050; FR-07677-1) Avail: CFSTI CSCL 20/2

A plasma torch having very high gas enthalpy and low contamination was developed for growing single crystals of very refractory materials. The torch consisted of a wall-stabilized, constricted-arc, nitrogen-plasma jet using 20-50 kilowatts of d-c power. A flow of purge gas prevented the vaporized tungsten electrode material from contaminating the plasma stream. The crystal-growing experiments used a muffle of sintered magnesium oxide and a Verneuil feed system. MgO seed crystals could be made to grow a few millimeters in height in several minutes time when the conditions were just right. Author (TAB)

N70-27936# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Mechanics.
ON THE NONLINEAR EQUATIONS OF THERMOELECTROELASTICITY
H. F. Tiersten Oct. 1970 46 p refs
(Contract N00014-67-A-0117-0007)
(AD-702113; TR-1) Avail: CFSTI CSCL 20/12

The differential equations and boundary conditions describing the behavior of an electrically polarizable, finitely deformable, heat conducting continuum in interaction with the electric field are derived by means of a systematic application of the laws of continuum coupled to a lattice continuum. The resulting rotationally invariant description of thermoelectroelasticity consists of five differential equations in five dependent variables and, when thermal considerations are omitted, reduces to four differential equations in four dependent variables. A variational principle is presented, which yields the same four differential equations of electroelasticity in the same four dependent variables along with the associated boundary conditions. Previous consistent variational treatments of electroelasticity yielded a system of seven equations in seven dependent variables. Author (TAB)

N70-27944*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SUPERCONDUCTING MAGNETS FOR ACTIVE SHIELDING
Eugene W. Urban *In its* Radiation Phys. Res. at MSFC: Res. Achievements Rev., v. 3 1969 p 13–18 (See N70-27942 14-24)
Avail: CFSTI CSCL 20L

Studies were conducted to explore and solve the problems involved with the use of high field superconducting magnets for active, space radiation shields. The characteristics of superconducting magnet systems, how they would be applied to a flyable space shield, the requirements of a shielding magnet system, and current and future research to contribute to the solution of some of the technological problems of superconducting magnets are summarized. Author

N70-28068*# Autonetics, Anaheim, Calif.
INVESTIGATION OF SINGLE CRYSTAL FERRITE THIN FILM
J. E. Mee, P. J. Besser, and E. C. Whitcomb Feb. 1970 65 p refs
(Contract NAS12-522)
(NASA-CR-86390) Avail: NASA Scientific and Technical Information Facility, P.O. Box 33, College Park, Md. 20740 CSCL 20L

State-of-the-art evaluation of the single crystal growth of lithium ferrite on magnesium oxide substrates is reported, with recommendations for improvements. Experiments were conducted on crystal growth by chemical vapor deposition (CVD), and it was determined that the zonal behavior characteristic of successful CVD of other magnetic oxides is also attainable with the Li-Fe oxide system. Epitaxial films of gadolinium iron garnet on gadolinium gallium garnet were also grown, and compared favorably with good quality bulk samples. Technical analysis of the crystals included magnetic, optical, and X-ray measurements. A schematic view of the deposition reactor is given. E.M.C

N70-28096# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Atomnoi Energii.
THERMIONIC SOURCE OF LITHIUM GLASS [TERMOINNYI ISTOCHNIK NA OSNOVE LITIEVOGO STEKLA]
A. I. Gurevich, Yu. A. Kucheryaev, and V. S. Nikolaenko 1969 28 p refs In RUSSIAN
(IAE-1810) Avail: AEC Depository Libraries

A thermionic source is described, whose emitter is a layer of lithium aluminosilicate glass (synthetic beta-eucryptite) deposited on the surface of a molybdenum core of 10-mm diameter. A cermet triode (GS-9B) circuit is used in the source. Results are given of measured total current and the emission components. At a temperature of 1250 C, the ionic current reaches 6 mka, and together with isotopes of L(+) 6 and Li(+) 7, ions of Na(+) and K(+) are emitted. The magnitude of the current of each component and their relations depend on the emitter temperature. The source of alkali ions described is comparatively better than sources having surface ionization and is useful in solving many problems in experimental physics. Author (NSA)

N70-28117# Illinois Univ., Urbana. Dept. of Mining Metallurgy and Petroleum Engineering.
IMPERFECTIONS IN SOLIDS Final Report
Theodore J. Rowland 15 Feb. 1970 11 p refs
(Grant AF-AFOSR-803-65)
(AD-702141; AFOSR-70-0284TR) Avail: CFSTI CSCL 20/12

The report describes investigations into several different aspects of the electronic structure of defects in solids. The effect of electronic polarization on the optical properties of insulators and some characteristics of the absorption bands in KCl are considered. A brief discussion of an experiment on the optical transmission properties of plastically deformed germanium is given. The bulk of the study is concerned with electron scattering from vacancies and solute atoms. This scattering is responsible for many of the properties of alloys and is investigated here through residual resistivity, the Kondo effect (which includes spin scattering), and electric field gradients in alloys. The effect on the residual resistivity of the Brillouin zone boundaries intersecting the Fermi surface is investigated and found to be very important, changing the theoretical value of the resistivity by a factor of 2 to 3 and bringing theory into agreement with experiment. Work on the band structure of bismuth and on the elastic constants of aluminum and lead is also mentioned. Author (TAB)

N70-28120*# Stanford Univ., Calif. Dept. of Materials Science.
MECHANISM OF THE PHOTOVOLTAIC EFFECT IN II-VI COMPOUNDS Progress Report, 1 Jan. – 31 Mar. 1970
Richard H. Bube, A. Fahrenbruch, and P. F. Lindquist 31 Mar. 1970 14 p refs
(Grant NGL-05-020-214)

(NASA-CR-109893; PR-8) Avail: CFSTI CSCL 20L

A correlation was made between the extensive series of measurements on non-heat-treated and heat-treated CuS-CdS cells. The results demonstrate that trapped charge in the interface region, manifested by photocapacitance measurements, is responsible for the enhancement and quenching effects observed in the photoresponse of heat-treated Cu2S-CdS heterojunctions. This trapped charge also affects the photoresponse of non-heat-treated junctions, but to a lesser extent. This trapped charge is a vital factor in the photovoltaic performance of the Cu2S-CdS cell. Whereas before heat treatment the dependence of short-circuit photocurrent on photocapacitance (trapped charge) is linear, the dependence after heat treatment is exponential; these are the kinds of dependences to be expected from a small spike in the conduction band at the interface. Properties of Cu-CdS cells prepared by vacuum evaporation of Cu have been investigated. Dependence of properties on etching of the surface is noted, as well as marked differences between A- and B-face CdS surfaces used for Cu evaporation. Author

N70-28137*# Rensselaer Polytechnic Inst., Troy, N.Y. Nuclear Science and Engineering Div.

INVESTIGATION OF THE STRUCTURE OF RADIATION DAMAGE IN LITHIUM-DIFFUSED SILICON Final Report, 3 Feb. - 8 Dec. 1969

J. C. Corelli and T. Mortka Dec. 1969 52 p refs Prepared for JPL

(Contracts NAS7-100; JPL-952456)

(NASA-CR-11001) Avail: CFSTI CSCL 20L

The effects of 1.5 and 5 MeV electron irradiation on Li-doped silicon were studied using infrared photoconductivity and infrared spectroscopy to probe the radiation-produced defects. The lithium was diffused in samples cut from oxygen-rich crucible grown silicon ingots or from oxygen-lean floating zone refined silicon. In all samples studied the starting material before Li diffusion had resistivities in the range 1 to 10 ohm-cm phosphorus doped. The lithium was diffused by heating to approximately 420 C a paste mixture of lithium metal in mineral oil and alumina painted on the surface. From the photoconductivity measurements we find an energy level was found at E sub c-0.62 eV which acts as an electron trap and is produced by radiation in nearly all samples irrespective of oxygen content. Other levels which give rise to defect photoconductivity are produced with predominant concentration. Strong lithium effects were observed on the 1.8 micron divacancy associated defect absorption band in which less of the 1.8 micron band is produced as the lithium concentration is increased. Absence of a clear divacancy level was found for all lithium concentrations studied which may be due to their low production rate at approximately 1.5-5MeV. Author

N70-28142# California Univ., Los Angeles. Dept. of Chemistry.

HEAVY ATOM, VIBRONIC AND HOST CRYSTAL PERTURBATIONS ON THE PHOSPHORESCENCE OF MOLECULAR CRYSTALS Annual Report, 15 Sep. 1968 - 14 Sep. 1969

Stanley Martin Ziegler 14 Sep. 1969 325 p refs

(Contract AT(11-1)-34)

(UCLA-34-P-91-25) Avail: CFSTI

The effects of some weak perturbations on the phosphorescence mechanism were studied by investigating the polarized phosphorescence spectrum of mixed single crystals of quinoline, isoquinoline, and their halogenated derivatives in biphenyl and durene host crystals at 4.2 K and 77 K. The spectrum of the parent compound, Subspectrum I, was found to persist in the halogenated derivatives. In addition, there appear new bands characteristic of the halogenated molecule, Subspectrum II. The role of the singlet state present in the heterocyclics with respect to the out-of-plane emission was investigated and it appears that it does not play an important role in the phosphorescence mechanism in biphenyl host crystal. It was found that considerations of relieving the strong host hydrogen-guest halogen repulsive interactions for the alpha and beta substituted heterocyclics could accurately predict which lattice modes would appear coupled with the guest emission in biphenyl. In contrast, the guest emission with durene is very sharp and shows little or no coupling with the lattice. Author (NSA)

N70-28156# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.

SPIN-LATTICE RELAXATION IN PERIODICALLY PERTURBED SYSTEMS

U. Haeberlen and J. S. Waugh 25 Feb. 1969 10 p refs

(Contract DA-28-043-AMC-02536(E))

(AD-701534) Avail: CFSTI CSCL 20/12

Spin-lattice relaxation theory is examined, in the perturbation-theory regime, for nuclear spin systems which experience time-dependent forces not only from fluctuating spin-lattice interactions but also from externally produced periodic disturbances. These include strong steady rf fields (spin-locking and the Lee-Goldberg experiments), amplitude and phase-modulated rf fields (pulsed narrowing experiments), and modulation of the secular dipolar fields through rotation of the sample. It is shown for relatively slow molecular motions that uncoupled Bloch equations can be obtained for suitably defined components of the magnetization. The spin-lattice relaxation times, which limit the degree of narrowing that can be obtained, depend in every case on Fourier components of the thermal motion in the neighborhood of the frequency of the periodic disturbance, and are of the same order of magnitude for all the experiments. Various narrowing experiments on substances having molecular motion are discussed. Author (TAB)

N70-28207 Catholic Univ. of America, Washington, D.C.

A SPECTROSCOPIC STUDY OF EXCITED STATES OF GROUP 2 IMPURITIES IN GERMANIUM WITH AN APPLIED MAGNETIC FIELD

William James Moore (Ph.D. Thesis) 1969 78 p

Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 69-19769

High resolution excitation spectra for the group 2 double acceptors beryllium, zinc, and mercury in germanium are obtained with an applied magnetic field for fields up to 30 kilogauss. The observed Zeeman spectra are functions of the g-factors of both the ground state and the excited states involved and do not directly measure the splitting of either state. Recent calculations indicate that the g-factors of the ground and excited states are of the same order of magnitude so both must be considered when comparing theory with the experiment. The observed spectra are compared to the theoretical spectra and suggestions for future work are made. Dissert. Abstr.

N70-28241 Cornell Univ., Ithaca, N.Y.

NUCLEAR MAGNETIC RESONANCE IN SOLID HELIUM 3-HELIUM 4 BETWEEN 0.3 K AND 2.0 K

Dennis Sadamu Miyoshi (Ph.D. Thesis) 1969 127 p

Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 69-20989

Nuclear magnetic resonance techniques was used to study vacancy diffusion and the exchange interaction of He(3) in solid He(3)-He(4) mixtures between 0.3 and 2.0 K for molar volumes between 20 and 22 cc/mole. The concentrations studied are 32.1, 7.78, and 1.94% He(3) in He(4). The diffusion minima appear to follow the inverse concentration dependence predicted by both the BPP and Torrey theories. There is good agreement between the diffusion activation energies. These activation energies are consistently lower for mixtures than for pure He(3). The value of the diffusion constant at the melting point of the solid appears to be independent of concentration, phase, and molar volume. The data in the Zeeman-exchange plateau region supports the idea of a single spectral density for each solid phase. This data also indicates that the exchange interaction is independent of concentration, e.g.,

the overlap between two neighboring He(3) wave functions depends only on the molar volume of the sample, and not on the He(3) concentration. The data in the exchange-narrowed region is not in agreement with the theory obtained by allowing the moments of the lineshape to become concentration dependent. The experimental values are much lower than the predicted values. This deviation is qualitatively explained by postulating the existence of two spin species: those that strongly experience the effects of exchange and those that do not. A small fraction of the do not spins can then dominate the relaxation process. Dissert. Abstr.

N70-28267# Dayton Univ., Ohio. Dept. of Physics.
THE GROUPING OF SPECTRAL LINES IN THE OPTICAL SPECTRA OF Gd(3+) IN CaF2 ACCORDING TO COMMON SITES Final Report, 1 Jan. 1967 - 30 Nov. 1968
Richard E. Ziegler, Perry P. Yaney, and John A. Detrio Dec. 1969 96 p refs
(Contract AF 33(615)-3793)
(AD-701393; AFML-TR-69-230) Avail: CFSTI CSCL 20/12

The spectral lines arising from the transitions between the octet S(7/2) ground state and the sextet P(7/2) (32100/cm) and sextet P(5/2) (32700/cm) manifolds of Gd(3+) in CaF2 at 77K are grouped according to the sites to which they belong. The classification is based on the relative line strengths or integrated absorption coefficients by which lines can be grouped according to common sites, but does not yield the symmetries of these sites. The effects of the Gd(3+) within the sample on the relative strengths of the identified sites are reported for the nominal dopings of 0.5, 0.1, and 0.05 mole per cent. The integrated absorption coefficients, wavelengths in air, and vacuum wavenumbers of the sextet P(7/2) and sextet P(5/2) groups are reported. Wavelengths in air and vacuum wavenumbers of the sextet I group in absorption and the sextet P(7/2) and sextet I(7/2) in fluorescence are also included. Author (TAB)

N70-28274# Franklin Inst., Philadelphia, Pa. Research Labs.
STUDIES ON THE CONDUCTIVITY PROPERTIES OF ORGANIC SOLIDS
Philip J. Reucroft and Eugene E. Hillman Dec. 1969 38 p refs
(Contract F19628-69-C-0129)
(AD-701452; S-C2426-1; AFCRL-69-550; SR-1) Avail: CFSTI CSCL 20/12

Charge-carrier trapping properties of aromatic molecular crystals have been investigated by thermally stimulated current and space charge limited current techniques. Thermally stimulated current studies on melt-grown, vapor-grown and irradiated melt-grown anthracene crystals in the temperature range 100K to 300K show minor differences in trapping behavior indicating that trapping phenomena involving dislocations and radiation induced impurities are not being measured in this temperature range by this technique. A thermally stimulated current peak is found in melt-grown chrysene crystals and vapor-grown tetracene crystals which is similar to that found in the anthracene crystals. The results suggest that a physical defect, as yet uncharacterized, which is present in all these crystals is probably responsible for the thermally stimulated current behavior in the temperature range studied. Thermally stimulated current studies on chrysene crystals with blocking and non-blocking electrodes indicate that injection of carriers through the metal electrode may be causing increased population of traps and shifting the trap depth to higher values. A hole injecting solution contact (AlCl3: anthracene in nitromethane) is found to function more efficiently with an anthracene crystal than an analogous solid contact obtained by evaporating the solvent to dryness. Author (TAB)

N70-28345# Emmanuel Coll., Boston, Mass. Oriental Science Research Library.
EFFECT OF GROWTH RATE ON THE STRUCTURE AND STACKING DISORDER OF SiC CRYSTAL GROWN BY THE LELY METHOD
Yoshizo Inomata et al Bedford, Mass. AFCRL Nov. 1969 27 p refs Transl. into ENGLISH from Yogyo Kyokai-Shi (Tokyo), v. 76, no. 8, 1968 p 268-276
(Contract F19628-68-C-0251)
(AD-701010; EMM-69-233; AFCRL-69-0516; AFCRL-Trans-63) Avail: CFSTI CSCL 20/2

The relation between the structure of SiC and its growth rate was studied at 2500 degrees C. The setting of the growth condition was improved by limiting the zone of recrystallization in the growth cavity. Super-saturation in the cavity was changed in several steps by the use of the cavity wall and thermo-insulator. Author (TAB)

N70-28487# California Univ., Livermore. Lawrence Radiation Lab.
IMPROVED CIRCUIT MODELS FOR INDUCTORS WOUND ON FERRITE CORES
R. W. Buntenbach and R. B. Mc Cann 29 Dec. 1969 15 p refs Presented at 3d Asilomar Conf. on Circuits and Systems, Pacific Grove, Calif. Sponsored by AEC
(UCRL-71983; Conf-691205-1) Avail: CFSTI

The magnetic impedance and its electrical equivalent are derived for the finite magnetic core containing permeability, conductivity and permittivity. The influence of ferromagnetic and domain wall resonances are discussed. Measurements are presented to illustrate the forms of impedance versus frequency characteristics which can be expected from the various types of ferrites. Author

N70-28490# California Univ., Berkeley. Lawrence Radiation Lab.
LOW ENERGY ELECTRON DIFFRACTION STUDIES OF PHASE TRANSFORMATIONS AT METAL SURFACES
Richard Martin Goodman (Ph.D. Thesis) Aug. 1969 163 p refs
(Contract W-7405-eng-48)
(PB-187921; UCRL-19008) Avail: CFSTI CSCL 20L

The post-acceleration technique of low energy electron diffraction in ultra-high vacuum was used to investigate phase transformations at metal surfaces. Investigations of possible order-order surface phase transformations at metal single crystal surfaces were undertaken on the (100) faces of silver, gold, palladium, and nickel. The clean Au (100) surface was found to undergo an order-order surface phase transformation designated Au (100)- 1 x 1 yields Au (100)-5x1 in the temperature range 300 to 500 K. Studies of the (100) surface of silver and nickel, as well as the (111) face of nickel, show that these surfaces retain stable (1x1) surface structure even under extreme vaporizing conditions at high temperatures. Lead, bismuth, and tin were melted in situ while monitoring the surface atomic arrangement by low energy electron diffraction. The (111), (100), and (110) surfaces of lead and the (0001) and (01-12) surfaces of bismuth retain an ordered (1x1) surface structures at all temperatures up to their respective bulk melting points. Author (USGRDR)

N70-28551# Pittsburgh Univ., Pa. Dept. of Chemistry.
MAGNETO-THERMODYNAMICS OF PARA- AND ANTIFERROMAGNETS Final Report, 1 Jun. 1964 - 31 May 1969
Richard A. Butera 31 May 1969 11 p refs
(Contract AT(30-1)-3402)
(NYO-3402-9) Avail: CFSTI

The strength of the exchange interaction is determined along with the boundary in the temperature-field plane which defines the ordered state for systems in which magnetic ordering occurs below 4 K. The magneto-thermodynamic properties of selected salts containing transition metal ions and other systems such as metals or intermetallics which exhibit appropriate cooperative magnetic effects at very low temperatures are investigated. The effect of the intrinsic magnetization of the Nb-Zr superconducting

magnet on the measurements obtained by use of a fluxmeter coil system located in close proximity to the bore wall of the magnet is also investigated. NSA

N70-28554# Joint Inst. for Nuclear Research, Dubna (USSR).
INVESTIGATION OF THE SURFACE SHF-RESISTANCE OF THE SECOND TYPE SUPERCONDUCTORS
N. B. Rubin, A. A. Sabaev, Yu. I. Smirnov, I. S. Khukhareva, and V. G. Shabratov 1969 16 p refs In RUSSIAN
(JINR-P8-4785) Avail: AEC Depository Libraries

The surface SHF-resistance of the superconducting alloys of the Nb - Zr and Nb - Ti type has been investigated. The measurements were performed at 500 MHz in the external magnetic field of 40 to 50 kOe . Commercial superconductors performed as wires are used. The techniques and the results of the experiment are described. Author (NSA)

N70-28588*# Kentucky Univ., Lexington. Dept. of Metallurgical Engineering and Materials Science.
RESEARCH STUDY OF STRUCTURAL DAMAGE PRODUCED IN SILICON SEMICONDUCTORS BY NEUTRON IRRADIATION Semiannual Report
Gordon A. Sargent May 1970 24 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952561)
(NASA-CR-110152) Avail: CFSTI CSCL 20L

Techniques were established to etch and observe undoped and lithium doped silicon solar cells by surface replication and by thin film transmission electron microscopy. From preliminary surface and thin film observations it appears that a second phase precipitate exists in the doped cells which has a bcc crystal structure and has a lattice parameter close to that of lithium. As lithium is the only bcc material present in any large amounts, it seems reasonable to conclude that in fact the precipitates are formed from excess lithium. Author

N70-28645 Minnesota Univ., Minneapolis.
RADIATION-INDUCED ELECTRICAL PHENOMENA IN THE ALKALINE EARTH OXIDES
Eugene Edward Olson (Ph.D. Thesis) 1969 109 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 69-20042

The photoconductivity and the photoinduced alternating-current Hall effect in MgO, CaO, and SrO single crystals which were doped with the respective alkaline-earth metal to produce anion vacancies are reported. These point defects trap one or two electrons to become respectively F or F prime centers. These centers as well as some impurities are found to release free electrical charge upon irradiation in the appropriate optical bands. Photoconductivity bands were observed in Mg: MgO at 5.0 eV and at 2.2 eV. The primary photoconductivity band is believed to result from the absorption of 5.0 eV quanta by the F or F prime centers, while the secondary photoconductivity at 2.2 eV is thought to be an impurity center populated with electrons during the ultraviolet irradiation. The 5.0 eV photo-induced Hall effect shows holes as the majority carrier, while the 2.2 eV photoinduced Hall effect indicates free electrons. Dissert. Abstr.

N70-28720*# Field Emission Corp., McMinnville, Oreg.
SINGLE CRYSTAL CLEAN WORK FUNCTIONS AND THE BEHAVIOR OF VARIOUS ADSORBATES ON METAL SURFACES Final Report
A. E. Bell, C. J. Bennette, R. W. Strayer, and L. W. Swanson Apr. 1970 119 p refs
(Contract NAS3-11820)
(NASA-CR-72657) Avail: CFSTI CSCL 20L

Work functions and temperature coefficients were determined by the relative field emission method for various planes of Re, Nb and Ni and for single planes of W, Nb, Ni, Cu and Re by an absolute method. Activation energies of desportion of neutral Cs atoms were measured as a function of coverage from W/O, W/F and Re substrates. Terminal neutral Cs desorption promoted removal of F but not O from W. Cs is more strongly bound to the (0001) and 1012) planes of Re than to the (1014) plane. Author

N70-28784# Utah Univ., Salt Lake City. Dept. of Physics.
THE FUNDAMENTALS OF RADIATION DAMAGE Progress Report, 1 Feb. 1969 - 1 Feb. 1970
A. Sosin 1 Feb. 1970 18 p
(Contract AT(11-1)-1800)
(COO-1800-9) Avail: CFSTI

After an account of equipment development (cryostats, accelerators, etc.), work on the Stage I annealing of electron-irradiated Cu is summarized. Other experimental and theoretical research is described briefly; some data on Young's modulus and internal friction in irradiated Cu are given. NSA

N70-28838*# Radio Corp. of America, Princeton, N.J.
VAPOR-PHASE GROWTH TECHNIQUE AND SYSTEM FOR SEVERAL III-V COMPOUND SEMICONDUCTORS Interim Scientific Report
J. J. Tietjen, R. Clough, R. Enstrom, M. Ettenberg, H. P. Maruska et al Apr. 1970 34 p refs
(Contract NAS12-538)
(NASA-CR-110194; ISR-3) Avail: CFSTI CSCL 20L

Excellent results were realized for the vapor-phase growth of III-V compounds containing aluminum. Single-crystalline AlAs was prepared with unprecedented stability and good electrical properties, including reproducible electron mobilities in excess of 280 cm2/V-sec, which is the highest value ever reported for AlAs. In addition, electron carrier concentrations as low as 10 to the 16th power/cu cm were achieved with this material, and it was used to fabricate the first stable AlAs p-n junction structures. The requisite conditions were defined for the growth of AlP and AlN, and a technique was developed for the preparation of AlSb. Improvements were made for the growth of GaN, and this resulted in improved crystallinity, surface perfection, and electrical properties for this compound. Also, higher electron mobilities were achieved with GaSb layers. The system developed has the capability of preparing an outstanding number of materials as single-crystalline layers, doped either n- or p-type, and in the form of multilayer structures, including p-n junctions. Author

N70-28844*# Brown Univ., Providence, R.I. Div. of Engineering.
INVESTIGATION OF THE EFFECTS OF SUB-THRESHOLD HIGH ENERGY ELECTRONS ON THE PROPERTIES OF SILICON PHOTOVOLTAIC CELLS Final Report, 3 Feb. - 3 Nov. 1969
J. J. Loferski and E. E. Crisman Feb. 1970 15 p Prepared for JPL
(Contracts NAS7-100; JPL-952386)
(NASA-CR-110151) Avail: CFSTI CSCL 20L

The report describes measurements of the photovoltaic characteristics of p/n lithium-doped cells; p/n conventional cells and n/p cells. An experimental comparison of damage rates in a lithium doped p/n cell and a conventional p/n cell at approximately 90 K has shown that no effects associated with displacement of lithium ions by electrons whose energy is too low to displace Si atoms has been detected. A difference in damage rates at 200 keV was observed with the lithium doped cell exhibiting very little damage even though Li ions are not mobile at approximately 90 K. A deflection circuit to produce a scanned electron beam pattern is described. A summary of work performed during this nine month contract is included. Author

N70-28852# Kernforschung Sanlage, Juelich (West Germany). Inst. fuer Festkoerper- und Neutronenphysik.
DEFECT PRODUCTION AND RECOVERY DURING

LOW-TEMPERATURE ELECTRON RADIATION OF TANTALUM [DEFEKTPRODUKTION UND ERHOLUNG BEI TIEFTEMPERATURE-ELEKTRONENBESTRAHLUNG VON TANTAL]

Dieter Meissner (Ph.D. Thesis—Tech. Hochschule, Aachen) 1970 70 p refs In GERMAN
(JUL-642-FN) Avail: CFSTI

Very pure tantalum foils were irradiated with electrons at 5 K and the structure of the defects and their thermal recovery up to 500 K was investigated by measuring the electrical resistance. The observed decrease of the damage rate was analyzed by below-threshold radiations with 1.2 MeV electrons. Saturation in the defect production was determined for 85% of the cases by below threshold impact processes, and only for 15% by spontaneous recombination. The active cross-section of below-threshold recombination, acting especially on very close Frenkel pairs, was 90,000 barn and the spontaneous recombination volume was 20 atom-volumes. These results were confirmed with radiation doping experiments. Author (ESRO)

N70-28865# Iowa State Univ. of Science and Technology, Ames.

SINGLE CRYSTAL SUSCEPTIBILITY STUDY OF ONE-DIMENSIONAL ANTIFERROMAGNETIC INTERACTIONS IN Cs Cu Cl SUB 3

Frank Joseph Rioux, III (Ph.D. Thesis) Nov. 1969 97 p refs
(Contract W-7405-eng-82)
(IS-T-326) Avail: CFSTI

The given graphs indicate that deviations from Curie-law behavior begin at approximately 55 K and least squares analysis of the data above 70 K yields values of Curie constants of 0.464 and 0.445 for the a- and c-axes. Structural evidence indicates the existence of infinite linear chains running parallel to the c-axis. Comparison of the experimental susceptibilities with calculations for linear Heisenberg antiferromagnets shows that one-dimensional interactions between nearest-neighbor copper ions on the chain predominate down to 30 K. Below 10 K the magnetic susceptibility along the c- and a-axes remains relatively constant and it is assumed that the spin alignment is canted with respect to the c-axis. Author

N70-28878# Michigan State Univ., East Lansing. Dept. of Physics and Astronomy.

THE MAGNETIC PHASE DIAGRAM OF DEUTERATED MANGANESE CHLORIDE

H. Forstat, P. T. Bailey, and J. R. Ricks 10 Jul. 1969 3 p refs
(Grant AF-AFOSR-0430-67)
(AD-701599; AFOSR-70-0486TR) Avail: CFSTI CSCL 20/12

The magnetic phase diagram of $MnCl_2 \cdot 4D_2O$, from 1 degree K to the Neel temperature, has been traced out, using an adiabatic calorimetric technique. The triple point was located at T = 1.19 degrees K and H sub c = 7550 Oe. Author (TAB)

N70-28888# Iowa State Univ. of Science and Technology, Ames.

SPIN SCATTERING IN SUPERCONDUCTORS

Larry John Williams (Ph.D. Thesis) Nov. 1969 98 p refs
(Contract W-7405-eng-82)
(IS-T-331) Avail: CFSTI

Thermal conductivity and single crystal neutron diffraction measurements were taken on La - Lu - Tb alloys in order to obtain information about the possible coexistence of superconductivity and an ordered magnetic impurity spin system. The neutron diffraction measurements were primarily intended to give information about correlations in the impurity spin system while the thermal conductivity results were primarily intended to provide information about the superconducting properties. These results are consistent with an absence of magnetic order in the impurity spin system. The thermal conductivity measurements also imply that superconductivity in this system is not filamentary but rather it is a bulk phenomenon. Author (NSA)

N70-28897# Scientific Translation Service, Ann Arbor, Mich.

LUMINESCENCE OF LIF CRYSTALS BY EXCITATION FROM REACTOR RADIATION

K. K. Shvarts et al Mar. 1970 9 p refs Transl. into ENGLISH from Latvijas PSR Zinatnu Akad. Vestis (Riga), v. 5, 1968 p 30 - 35 Transl. for Argonne Natl. Lab.
(ANL-Trans-810) Avail: CFSTI

The radioluminescence and thermoluminescence of various LiF crystals were investigated upon excitation by unfiltered and filtered (1 mm cadmium) radiation of the reactor. The efficiency of radioluminescence of all the investigated crystals drops sharply in the temperature region of stabilization of V sub k centers. Upon excitation by filtered reactor radiation the efficiency of radioluminescence and thermoluminescence per absorbed unit dose is considerably higher. This is related to the influence of the density of the exciting radiation. Author (NSA)

N70-28917# Hamburg Univ. (West Germany). Inst. fuer Angewandte Physik.

ENERGY LOSS MEASUREMENTS FOR THE DETERMINATION OF OPTICAL CONSTANTS OF NOBLE METALS, TRANSITION METALS AND RARE EARTHS [ENERGIEVERLUSTMESSUNGEN ZUR BESTIMMUNG VON OPTISCHEN KONSTANTEN AN EDEL-, UEBERGANGSMETALLEN UND SELTENEN ERDEN]

Juergen Daniels (Ph.D. Thesis) 1969 37 p refs In GERMAN
Sponsored by Deut. Forsch. Gemeinschaft
Avail: CFSTI

Energy losses by high energy electrons in the transition metals rhodium, palladium, platinum, the noble metals copper, silver and gold, as well as the rare earths gadolinium and dysprosium, were measured. The energy loss function was determined from the energy loss intensities in the forward direction and at small scattering angles, and the optical constants were calculated with the Kramers-Kronig solution relation. These constants were compared with those determined by optical measurements and found to be in good agreement. ESRO

N70-28931# Cornell Univ., Ithaca, N.Y. Materials Science Center.

THE JOSEPHSON JUNCTION AS SOURCE OF FAR-INFRARED RADIATION

Richard Keith Elsley (M.S. Thesis) Jan. 1970 33 p refs
(Contract AT(30-1)-2391)
(NYO-2391-100; Rept-1252) Avail: CFSTI

Radiation produced by a Josephson junction located inside a resonant cavity was detected. Indirect evidence indicates that this radiation is in the far-infrared, at frequencies of from 2/cm to 13/cm (60 to 400 GHz). Power levels of up to 10 nanowatt were observed. Author (NSA)

N70-28961# Toulouse Univ. (France). Faculte des Sciences.

HIGH ENERGY PROTON EFFECTS ON ELECTRICAL PROPERTIES OF SILICON AND GERMANIUM SINGLE CRYSTALS [EFFETS DES PROTONS DE GRANDE ENERGIE SUR LES PROPRIETES ELECTRIQUES DU SILICIUM ET DU GERMANIUM]

Danielle Bielle-Daspet (Ph.D. Thesis) 1970 249 p refs In FRENCH; ENGLISH summary
Avail: CFSTI

Radiation effects on the carrier density, mobility and lifetime of silicon and germanium samples were studied with 207 and 590 MeV protons from the CERN synchrocyclotron and 300 MeV protons from the French synchrotron Saturne. Observed degradations were 60 to 100 times those produced on the same samples by 4.5 MeV electrons. Proton effects were connected with large perturbed lattice regions. The study of N and P type silicon and germanium single crystals includes (a) resistivities from 0.1 to 100 ohms cm, (b) doping by P, As or Sb or B and Al, and (c) crystals of 1.0.0 and 1.1.1. lattice orientation made by pulling or floating zone

methods. Transport properties were measured and carrier lifetime analyzed as functions of the irradiation dose. Energy levels, capture cross-section ratios and annealing of the recombination centers were derived from additional temperature and isochronal studies, up to 600 C. Results indicate that large perturbed lattice regions, called big dilute defects, are created at the same time as the disordered regions in germanium, and alone govern the proton effects in silicon samples. These defects are characterized by large extent and rather low density of atomic displacements.
Author (ESRO)

N70-28987*# National Bureau of Standards, Washington, D.C. Electronic Technology Div.
METHODS OF MEASUREMENT FOR SEMICONDUCTOR MATERIALS, PROCESS CONTROL, AND DEVICES Quarterly Report, 1 Oct. – 31 Dec. 1969
W. Murray Bullis, ed. May 1970 64 p refs Supported jointly by NBS, DASA, Navy, and NASA
(NASA-CR-110211; NBS-TN-527) Avail: SOD $0.60 Catalog No. C13.46:527; CFSTI

Activities directed toward the development of methods of measurement for semiconductor materials, process control, and devices are described. Principal emphasis is placed on measurement of resistivity, carrier lifetime, and electrical inhomogeneities in semiconductor crystals; evaluation of wire bonds, metallization adhesion, and die attachment; and measurement of thermal properties of semiconductor devices and electrical properties of microwave devices. Work on related projects on silicon nuclear radiation detectors and specification of germanium for gamma-ray detectors is also described.
Author

N70-28998# Iowa State Univ. of Science and Technology, Ames.
OPTICAL PROPERTIES OF SILVER-PALLADIUM ALLOYS
Bruno Francis Schmidt (Ph.D. Thesis) Nov. 1969 107 p refs
(Contract W-7405-eng-82)
(IS-T-325) Avail: CFSTI

Normal incidence reflectance and transmittance measurements were made on thin vacuum-evaporated films of five silver-palladium alloys. The film thicknesses were approximately 1000 A and the palladium concentrations ranged from 0 at.% to 15 at.%. In addition, the fractional change in reflectance with strain was measured for films of four silver-palladium alloys having palladium concentrations from 0 at.% to 4 at.%. The data yielded the dielectric constant and the change in the dielectric constant with strain from 1.8 to 4.6 eV. These were then related to the electronic behavior of the alloys. A broad absorption band centered at 2.6 eV appears upon alloying, and increases in size with increasing palladium concentration. This band is due to localized electron levels associated with the palladium impurity atoms. The peak in the loss function near 3.8 eV decreases and broadens rapidly with alloying. An overlap between the localized level absorption band and the loss function peak indicates that excitation of localized electrons is an important mechanism for the damping of plasma oscillations in the alloys. The 3.87 eV absorption edge in pure silver was observed to change little with alloying, except for a slight broadening.
Author

N70-28999# Iowa State Univ. of Science and Technology, Ames Labs.
OPTICAL PROPERTIES OF CHROMIUM-MANGANESE ALLOYS
Laurence William Bos (Ph.D. Thesis) Nov. 1969 92 p refs
(Contract W-7405-eng-82)
(IS-T-327) Avail: CFSTI

The antiferromagnetic energy gap and optical properties of single crystals of Cr alloyed with 0.45, 0.94, 2.5, and 4.5% Mn and 1.05% Re were investigated by the method of optical absorption over a photon energy range of 0.08 to 5 eV. The data were taken at 4.2 K by a calorimetric technique. It is found that at 4.2 K, approximately 1% Mn or Re will cause the commensurate antiferromagnetic order, and the energy gap shifts abruptly from 0.13 to 0.36 eV near this concentration of diluent. Evidence is given for indirect transitions occurring across a double energy gap in the noncommensurate samples, and the results are explained in terms of a band model. The widths of the absorption peak and the peak in epsilon sub 2 in the commensurate samples are discussed in terms of a gap anistropy and impurity broadening. Optical absorption peaks near 1, 2, and 3.4 eV are associated with direct interband transitions and symmetry points. It is explained that the 1 eV absorption may be partly due to transitions from the Fermi surface to the flat unoccupied band.
Author

N70-29002# Hamburg Univ. (West Germany). Inst. fuer Mineralogie und Petrographischen.
INVESTIGATIONS OF THE CRYSTAL STRUCTURE OF DARAPSKITE, Na3(SO4,NO3)-H2O [UNTERSUCHUNGEN ZUR KRISTALLSTRUKTUR VON DARAPSKIT, NA3 (SO4/NO3).H2O]
Helga Vetter (Ph.D. Thesis) 1969 68 p refs In GERMAN
Avail: CFSTI

Darapskite Na3(SO4/NO3).H2O crystallizes monoclinically in the space group P2 sub 1/m and contains two formula units per elementary cell. For the structural determination a natural polysynthetic twinning crystal was used. The atomic parameters (except hydrogen) were determined with two-dimensional Patterson- and Fourier methods and refined up to R = 0.092 with 1032 three-dimensional intensity data using a least squares method.
ESRO

N70-29008# Johns Hopkins Univ., Baltimore, Md. School of Hygiene and Public Health.
CRYSTAL STRUCTURES OF DIMERS OF URACIL AND 6-METHYLURACIL
M. N. Khattak, S. Y. Wang, John Konnert (NRL, Washington, D.C.), John W. Gibson (NRL, Washington, D.C.), and Isabella L. Karle (NRL, Washington, D.C.) [1969] 12 p refs Sponsored in part by Public Health Serv.
(Contract AT(30-1)-2798)
(NYO-2798-51) Avail: CFSTI

Crystal structure analyses were performed on an adduct of thymine and a trimer of thymine in addition to the cis-syn, cis-anti, and trans-anti cyclobutyl dimers of uracil and thymine derivatives. The analyses show remarkable agreement in bond lengths and angles of the molecules even though the packing and hydrogen bonding, if any, are quite different for the various materials. The cis-syn and cis-anti forms all have a puckered four-membered ring with a dihedral angle of approximately 155 deg except for the cis-syn photoproduct from 1,1-trimethylene bisthymine where the trimethylene bridge appears to force the cyclobutyl ring into a planar configuration. The two structure determinations of the trans-anti form show that the molecules themselves have a center of symmetry and consequently the four-membered rings must be planar. Two additional structure determinations are reported for uracil and 6-methyluracil.
Author

N70-29019*# Colorado Univ., Boulder. Dept. of Electrical Engineering.
THE APPLICATION OF SEMICONDUCTORS TO QUASI-OPTICAL ISOLATORS FOR USE AT SUBMILLIMETER WAVE LENGTHS
M. Kanda, G. Masciet, W. G. May, and R. E. Hayes Apr. 1970 61 p refs
(Grant NGL-06-003-088)
(NASA-CR-86379) Avail: CFSTI CSCL 20L

An experimental and theoretical investigation of the utilization of anisotropic effects in semiconductor plasmas for the development of submillimeter wavelength isolators is described. The topics

reported or include a new type of isolator that depends on reflection from a semiconductor surface, and one which uses Faraday rotation in semiconductors. Experiments at 94GHz that verify the basic validity of the reflection isolator theory are reported. The theory of these devices predicts that room temperature operation at 118 microns, using InSb and a magnetic field of 16 kG, with a forward loss of much less than one db and a reverse loss of about 25 db is possible. The analytical study of Faraday rotation isolators also predicts forward losses of less than one db. Author

N70-29066# Societe Europeenne de Semiconducteurs et de Microelectronique, Paris (France).
LOCALIZED EPITAXY BY IODINE TRANSFER Final Contract Report [EPITAXIE LOCALISEE PAR TRANSFERT A L'IODE. Compte Rendu de Fin de Contrat]
R. Dubois and H. Valdman Sep. 1969 65 p refs In FRENCH
(Contract DGRST-67-90-859-00-212-75-01)
(RD/AD-600) Avail: CFSTI

Among the various procedures for obtaining silicon p-n junctions with plane structure and abrupt transition, the localized epitaxy of silicon by iodine transfer appears to be one of the best. The thermodynamic equilibrium of silicon and iodine was studied for (1) an isothermal system containing silicon or iodine in excess, and (2) the evolution of two systems at different temperatures. The growth rate, localization (nucleation), and doping of the deposits are described. The localized epitaxy by iodine transfer is compared with other procedures for manufacturing abrupt junctions, and future improvements of the first method are suggested, e.g. outgassing at pressures lower than 0.000001 mm Hg. ESRO

N70-29073# Oak Ridge National Lab., Tenn. Health Physics Div.
OPTICAL CONSTANTS OF CESIUM FOR PHOTONS OF ENERGY 5 TO 9.6 eV
U. S. Whang (M.S. Thesis—Tennessee Univ., Knoxville) Mar. 1970 79 p refs Sponsored in part by NSF
(Contract W-7405-eng-26)
(ORNL-TM-2622) Avail: CFSTI

The optical constants of cesium films evaporated onto CaF2 substrates at 0.000001 Torr have been determined in the spectral region from 1294A (9.59 eV) to 2377 A(5.22 eV) from the critical angle marking the onset of total reflection. The refractive index n is determined from the critical angle of the reflectance curves of each wavelength. The absorption coefficient k is estimated from the slope of the curve at the critical angle. The real part of the complex dielectric constant epsilon sub 1 is consistent with a nearly free-electron model for photon energies less than 7.7 eV(1613A). For photon energies greater than 7.7 eV, epsilon sub 1 is greater than the nearly free-electron model would predict. This effect is attributed to the existence of transitions from inner shells at energies > or approximately 11.4 eV. The measured optical parameters are m sub opt/m = 1.25,h omega sub p = 2.85 eV, and 4 pi n sub 0 alpha sub 1 = .20. In epsilon sub 2 we find a broad peak centered at about 4.5 eV. This optical absorption may be explained by the existence of plasmon-assisted transitions. Author

N70-29110# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Festkoerper- und Neutronenphysik.
LATTICE DYNAMICS OF SOLID HYDROFLUORIC ACID [GITTERDYNAMIK VON FESTEM FLUORWASSERSTOFF]
Peter Borsch (Ph.D. Thesis—Tech. Hochschule, Aachen) Jan. 1970 85 p refs In GERMAN
(JUL-636-FN) Avail: CFSTI

The energy distribution of neutrons, scattered by solid hydrofluoric acid at 176 K at 5 different angles, was measured with a time of flight spectrometer. The distribution showed maxima at 7, 11, 17, 28 and 75 MeV, independent of scattering angle. These results were compared with those from optical investigations and both sets of data are interpreted on the basis of a simple lattice model but one transition remains unexplained in the optical observations. Author (ESRO)

N70-29128# Emmanuel Coll., Boston, Mass. Oriental Science Research Lab.
RELATION BETWEEN GROWTH TEMPERATURE AND THE STRUCTURE OF SiC CRYSTALS GROWN BY THE SUBLIMATION METHOD
Yoshizo Inomata et al Bedford, Mass. AFCRL Nov. 1969 24 p refs Transl. into ENGLISH from Togyo Kyokai-Shi (Tokyo), v. 76, no. 9, 1968 p 313-319
(Contract F19628-68-C-0251)
(AD-701008; EMM-69-234; AFCRL-69-0515; AFCRL-Trans-62) Avail: CFSTI CSCL 20/2

The relationship between growth temperature and the polytypes of SiC crystals has been studied experimentally at 2200 degrees C to 2600 degrees C under conditions of low supersaturation. The results are summarized as follows: (1) In the present experiment, excluding one example in which the 4 H-type was involved, the structure of all crystals consisted of the 6 H-, 15 R- and other long c-period types exceeding 21. Of the elemental structures of SiC, 2 H, 3 C, 4 H, 15 R, 6 H, and 21 R, only 6 H and 15 R were found. (2) In the range of 2200 degrees C - 2600 degrees C, 6 H and 15 R have the most thermal stability among the structures considered as elemental. However, the effect of impurity in the crystal and the shift from stoichiometry were neglected. (3) The relative amount of 15 R increased with decreasing temperature while 6 H showed the opposite tendency. Author (TAB)

N70-29131# Iowa State Univ. of Science and Technology, Ames. Dept. of Physics.
NUCLEAR MAGNETIC RESONANCE IN TRANSITION METAL BORIDES
Roger Bryan Creel (Ph.D. Thesis) Nov. 1969 194 p refs
(Contract W-7405-eng-82)
(IS-T-323) Avail: CFSTI

The environment of the boron nucleus in the transition metal borides was studied, utilizing the methods of nuclear magnetic resonance. The electric field gradient parameters at the boron site were measured in several monoborides by analysis of the B-11 nmr spectra. This analysis was facilitated by comparison of the experimental traces with synthetic derivative line shapes generated by a computer. The experimental values of both eta and nu sub Q are an order of magnitude smaller than predicted on the basis of strong covalent bonding between neighboring boron atoms. The temperature dependence of the B-11 nmr signal was used to determine the Neel temperature of CrB2. The nmr signal vanishes without shifting or broadening as the Neel temperature is approached, which indicates the antiferromagnetic ordering is without local moment, as in pure Cr. Author (NSA)

N70-29171# Argonne National Lab., Ill. Physics Div.
HARTREE-FOCK SELF-CONSISTENT FIELD CALCULATIONS FOR IRIDIUM
L. W. Panek and G. J. Perlow Nov. 1969 42 p refs
(Contract W-31-109-eng-38)
(ANL-7631) Avail: CFSTI

Nonrelativistic Hartree-Fock self consistent field calculations have been carried out for a set of 55 outer electron configurations (core) in iridium (Z=77) by use of the CDC-3600 computer. The calculation of the electron density at the nucleus, rho(0), as a function of N, M, and K and a fit by an analytical expression containing lowest order shielding effects are discussed. The calculations are a basis for a quantitative study of the isomer shifts in the Mossbauer spectra of iridium compounds. In addition to rho(0), we report the values of the one electron energy parameters, the mean values of various functions of r, the screening parameters, and the initial slope parameter. Author

N70-29189# Case Western Reserve Univ., Cleveland, Ohio Dept. of Physics.
MOESSBAUER EFFECT OF ULTRA THIN IRON FILMS
Anthony Charles Zuppero Jan. 1970 64 p refs
(Contract AT(11-1)-623)
(COO-623-149; TR-62) Avail: CFSTI

The analyzer system utilized an asymmetric triangle as the velocity relation between source and absorber, which simplified the analysis by not requiring folding of data before observation. The results of the thinnest film indicate that the bonding is that of atoms on a surface and that the type of site occupied by any film atom is equivalent to that occupied by any other. As the surface density of atoms is increased a broad, almost featureless resonance appears. In one sample part of the feature-free spectrum was converted to that spectrum characteristic of stable magnetic behavior by application of small magnetic fields and in others by cooling to liquid nitrogen temperatures. The thickest films exhibited either the bulk value of internal magnetic fields within 20% or non-magnetic spectrum. Author

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N70-27919# IIT Research Inst., Chicago, Ill. Technology Center.
PHYSICAL NATURE OF PROPELLANT SENSITIVITY Final Report, 1 Dec. 1966 - 30 Nov. 1969
Ted A. Erickson 30 Nov. 1969 75 p refs
(Contract F44620-67-C-0036)
(AD-700423; IITRI-C6099-3; AFOSR-70-0223TR)

Interphase transformations were studied with emphasis on fundamentals and their relationship to problems that exist in the explosive sensitivity of liquid propellants. Vaporization and vapor-supply mechanisms play an important role in the sensitivity of condensed-phase propellant systems but their quantitative classification and assessment are difficult to realize. A pseudo-thermodynamic vaporization coefficient, independent of rate and equipment influence was evaluated for water and introduced into the literature. Data for three other liquids, carbon tetrachloride, chlorobenzene and butanol, were statistically analyzed and results will be published. Consideration of chemical reaction analogs of this treatment was limited. A mechanism, namely, the fracture of a liquid system under hydrostatic tensile forces is proposed by which liquid systems can vaporize or supply vapor in an explosive fashion. Preliminary verification of this mechanism for liquids in states of negative pressure was obtained and supplemented by related experiments with flashlamp heated gas-black surfaces in contact with both inert and reactive liquids. Author (TAB)

N70-27965*# Rocketdyne, Canoga Park, Calif.
LITHIUM-FLUORINE-HYDROGEN PROPELLANT INVESTIGATION Final Report
H. A. Arbit, S. D. Clapp, and C. K. Nagai May 1970 241 p refs
(Contract NAS3-11230)
(NASA-CR-72695; R-8039) Avail: NASA Scientific and Technical Information Facility, P. O. Box 33, College Park, Md. 20740 CSCL 21I

Results are reported of a three-part program in the investigation of the Li/F2/H2 tripropellant combination. Objectives of the program were: (1) to investigate the feasibility of a simplified injection method, (2) to measure thrust chamber heat flux, and (3) to determine specific impulse efficiency at simulated altitude conditions. Nominal test conditions were: P sub c = 750 psia F2/Li mixture ratio = 2.74, H2 = 20 to 35 percent. Experimental firings give the following results: (1) a simplified injection method involving the use of a fuel-rich LF2/CH2 gas generator is feasible, with corrected efficiency of approximately 98 percent at nominal test conditions, (2) Li/F2/H2 flux is approximately 10 B/sq in./sec in the combustion chamber and 16.7 B/sq in./sec at the throat at nominal test conditions, and (3) measured Li/F2/H2 specific impulse efficiency with a 60:1 expansion ratio nozzle is 95 percent at nominal test conditions, corresponding to a calculated vacuum specific impulse of 509 lbf/lbm/sec deliverable by a regeneratively cooled engine. No lithium system operational problems were encountered. Author

N70-28448# Picatinny Arsenal, Dover, N.J.
RELATION BETWEEN THE TENSILE MODULUS OF PROPELLANTS AND THE FAILURE TIME
Elise Mc Abee and David W. Lavi Jan. 1970 33 p refs
(AD-699929; PA-TM-1902) Avail: CFSTI CSCL 21/9

The object of this work was to determine whether failure time for polymeric materials can be related to tensile modulus. An effort is made to develop a relation between 1% tensile modulus and failure times for certain propellants. Author (TAB)

N70-28466 Advisory Group for Aerospace Research and Development, Paris (France). Propulsion and Energetics Panel.
THE PERFORMANCE OF CHEMICAL PROPELLANTS
Irvin Glassman (Princeton Univ.) and Robert F. Sawyer (California Univ., Berkeley) Slough, Engl. Technivision Serv. Jan. 1970 140 p refs
(AGARDOGRAPH-129) Copyright. Avail: Technivision, Braywick House, Maidenhead, Berks, Engl. US Distributor: Circa Publications Inc., 415 Fifth Ave., Pelham, New York 10803 (Attn. Mr. A. L. Candido)

The performance of chemical propellants is evaluated. Thermodynamic values of combustion chambers, flame temperature, and equilibrium effects on nozzle expansion were calculated theoretically. Reaction kinetics of nonequilibrium combustion in chambers were investigated for rocket propellant systems. Propellant selection was based on thermodynamic and system criteria. It was found that the mixture ratio, pressure, expansion ratio, assumed products, and enthalpy values had effects on performance. S.S.

N70-28685# Bureau of Mines, Bartlesville, Okla.
COMPARATIVE EMISSIONS FROM SOME LEADED AND PROTOTYPE LEAD-FREE AUTOMOBILE FUELS
B. H. Eccleston and R. W. Hurn May 1970 28 p refs
(BMRI-7390) Avail: CFSTI

The effect upon automobile emissions in changing from leaded to lead-free gasolines was studied. Typical U.S. leaded gasolines and prototype lead free gasolines of comparable octane quality were used in eight vehicles operated to simulate city driving. The experiments were run at 70 and 95 F. Exhaust and evaporative emissions were measured and the photochemical effect of the emissions was experimentally observed in an artificial smog chamber. Results reveal the manner and degree in which the changes in fuel composition alter the amount and characteristics of both exhaust and evaporative emissions. It is shown that the compositional differences between leaded and prototype lead free fuels resulted in higher photochemical pollution potential of the emissions from the lead free fuels. The effect is attributed to the photochemical characteristics of high octane fuel components that are used in greater quantity in the lead free fuels. Author

N70-28736*# Pressure Systems, Inc., Los Angeles, Calif.
SPECIMEN/CAPSULE PREPARATION USED ON THE JPL MATERIAL COMPATIBILITY PROGRAM Final Report, Aug. 1967 - Apr. 1970
Dale W. Cox Apr. 1970 81 p refs Prepared for JPL

(Contracts NAS7-100; JPL-952004)
(NASA-CR-110148; PSI-525902-1) Avail: CFSTI CSCL 21I

Technical procedures in a program of material compatibility testing are presented. The material specimens prepared covered a wide range of metals, as well as many polymers, used in spacecraft construction. The material specimens were loaded in glass capsules, filled with a propellant and hermetically sealed. Production line procedures were developed for: (1) preparing material specimens in quantity and ensuring traceability and complete documentation of physical data on each specimen; (2) conducting typical spacecraft production processes, such as welding, on certain specimen lots; (3) preparing carefully annealed glass capsules with strain gages bonded to the exterior surface, resulting in a test capsule/transducer; (4) carefully cleaning specimens and glass capsules in a Clean Room Trailer; (5) loading the material specimen in the capsule/transducer; (6) fusing a glass reducer section to the glass capsule neck; (7) calibrating the capsule/transducer; (8) filling the capsule/transducer with propellant; and (9) hermetically sealing the capsule/transducer. Author

N70-28801*# Battelle Memorial Inst., Columbus, Ohio.
RADIATION EFFECTS ON LIQUID PROPELLANTS Final Report
J. F. Kircher, R. E. Best, and J. E. Rollins 2 Feb. 1970 46 p refs Prepared for JPL
(Contract NAS7-722)
(NASA-CR-109767) Avail: CFSTI CSCL 21I

The effects of ionizing radiation on selected liquid propellants were investigated and preliminary development of a comprehensive computer program for shield optimization was completed. Gamma-ray attenuation parameters for six candidate propellant materials were calculated. These data are formulated into linear attenuation coefficients and buildup factors which are tabulated. A logic flow diagram for generalized weight optimization to select shield configurations for various propellant materials was generated and a simplified computer program which minimizes the weight of a primary direct laminated shield was developed. Radiation effects on three fuels and three oxidizers were investigated in several container materials and over a range of dose rates. Propellant materials investigated include: FLOX, oxygen difluoride, nitrogen tetroxide (inhibited and uninhibited), diborane, hydrazine, and the LPG fuel, propane. In general, it was found that oxidizers are much less susceptible to radiation induced decompositon than fuels and differences due to dose rate are generally not large. Author

N70-28809*# Techtran Corp., Glen Burnie, Md.
CALCULATION OF TRANSITORY REGIMES IN THE COMBUSTION OF SOLID FUEL IN A CHANNEL [RASCHET PEREKHODNYKH REZHIMOV GORENIYA TVERDOGO TOPLIVA V KANALE]
V. B. Librovich et al Washington NASA Jun. 1970 18 p refs Transl. into ENGLISH from Zh. Prik. Mekhan. i Tekhn. Fiz. (Moscow), no. 5, 1969 p 33-41
(Contract NASw-2037)
(NASA-TT-F-13013) Avail: CFSTI CSCL 21B

Transitory regimes are studied for diffusion combustion occurring when an oxidizer is added from outside the solid fuel composition. Transition from one regime to another is detected by a change in oxidizer consumption. To calculate the transitory regimes a combustion model is used, based on the limiting role of mass transfer. Pressure changes are observed which lag behind changes in oxidizer feed, as well as transitory regimes characterized by formation of dynamic gas waves which cause pressure pulsations alternately reverberating from the front of the channel to the jet. A system of equations describing the static and transitory regimes of combustion, and a finite differential method for integrating them, are proposed. The behavioral laws of the solutions are evaluated. Author

N70-28884# National Aviation Facilities Experimental Center, Atlantic City, N.J.
STUDY OF TURBINE ENGINE OPERATION WITH GELLED FUELS Interim Report, 1968 - 1969
Robert F. Salmon May 1970 24 p ref
(FAA-DS-70-6; FAA-NA-70-6) Avail: CFSTI

Three types of gelled Jet A-1 fuels were tested to determine the compatibility of the thickened fuels with typical turbojet engines. The three fuels were: (1) Gel A, a 2-percent concentration of a styrene polymer additive in Jet A-1, (2) Gel B, a 2-percent concentration of a sodium-free styrene polymer additive in Jet A-1, and (3) Gel C, an aluminum octoate gel in Jet A-1, concentrations ranging from 0.2 to 1.0 percent. The two polymer gels had a 13,000-centipoise reading on the Brookfield Viscometer, RVT model, and the aluminum octoate ranged from 2,800 to 13,000 centipoises. Spray pattern tests were run with the fuels and a 1-hour engine test was conducted on a J47 engine. Comparison of engine performance when using regular JP-4 and polymer gelled Jet A-1 fuels indicated that the gel did not markedly affect the engine performance in the power range from 70 to 95 percent of rated engine r/min. The polymer gels, however, could not be used from engine light-off to idle power in the J47 engine since they required higher fuel manifold pressures for vaporization than the engine could produce during the starting sequence. Author

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N70-27821# Battelle Memorial Inst., Columbus, Ohio. Defense Metals Information Center.
CURRENT AND FUTURE USE OF MATERIALS IN AIRCRAFT GAS TURBINE ENGINES
W. F. Simmons and H. J. Wagner 1 Feb. 1970 35 p refs
(Contract F33615-69-C-1343)
(AD-701371; DMIC-Memo-245) Avail: CFSTI CSCL 21/5

The memorandum discusses the applications of heat-resistant metallic materials in aircraft gas turbine engines. Brief background information on the engines of each of the manufacturers is followed by a detailed discussion of the materials used in various components of the engines. Some current trends in turbine-engine materials applications are pointed out. An extensive appendix arranged according to manufacturer, lists materials used in recent and current engines and presents some brief data on size, weight, and application of each of the engines. Author (TAB)

N70-27822# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
REFRACTION OF SOUND BY A JET: A NUMERICAL STUDY
L. Schubert Dec. 1969 142 p refs Revised
(Grant AF-AFOSR-0672-67)
(AD-701370; UTIAS-144-Rev; AFOSR-69-3039TR) Avail: CFSTI CSCL 21/5

The equations appropriate to the propagation of sound in a realistic jet flow have been solved by finite - difference methods for the case of a sinusoidal point source on the axis of a subsonic jet. Each numerical solution provides detailed phase and amplitude information throughout the sound field. At the high frequency limit the finite - difference results agree with ray-tracing results. Also, the computed far-field directivity patterns generally agree well with available experimental data and lend further support to the view that the downstream valley in jet noise is due to refraction rather

than to the inherent directivity of the sound generated within the region of turbulence. Unexpected findings are that the flow beyond 100 nozzle diameters continues to deepen the refraction valley significantly, and that the sound pressure level reduction at a fixed point on the axis at first increases as the source is moved downstream from the nozzle. For the application of the refraction results to the computation of jet noise directivity, it is found that the distortion of the constant phase surfaces can be neglected except at high frequencies. Author (TAB)

N70-27939*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PERFORMANCE AND DIAGNOSTICS OF A WATER-COOLED MAGNETOPLASMADYNAMIC ARC THRUSTER

Denis J. Connolly, Ronald J. Sovie, and George R. Seikel Washington May 1970 39 p refs

(NASA-TN-D-5836; E-5561) Avail: CFSTI CSCL 21H

The performance of a water-cooled MPD arc thruster using ammonia propellant was studied for a range of operating conditions. Thrust efficiency increased with arc power and with mass flow rate. Thrust efficiency also increased with increasing specific impulse if the specific impulse was raised by increasing the arc power at constant mass flow rate. At constant arc power, thrust efficiency was insensitive to magnetic field strength. The effects of background pressure and magnetic field shape on thruster performance were also studied. By using electrical measurements, such quantities as energy and beam efficiencies, maximum fraction of ionization, and rotating spoke characteristics were determined. By spectroscopic techniques, the composition of the plasma exhaust, the radial and axial profiles of the spectral lines, and the axial velocities of the various species in the exhaust were determined. The variation of all these quantities was studied for a range of thruster operating conditions. Author

N70-27949*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.

PRELIMINARY DATA FOR PLUME DEFINITION OF THE R4D ENGINE FOR THE COMMAND SERVICE MODULE REACTION CONTROL SYSTEM

13 Sep. 1968 15 p refs

(Contract NAS8-20082)

(NASA-CR-102685; TN-54/20-30; LMSC/HREC-A791774) Avail: CFSTI CSCL 21H

Preliminary exhaust plume characteristics for the R4D engine that is used by the reaction control system of the command service module are presented. The operating characteristics of this engine are provided. The plume flow field for the R4D was generated using Lockheed/Huntsville's Method of Characteristics (MOC) computer program. The MOC program utilizes data generated by the NASA/Lewis thermochemical program to account for real gas effects. Because the prediction of a real gas, three dimensional, plume flow field is a highly complex problem, certain assumptions were made to simplify the analysis. Author

N70-27959*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

DESIGN POINT STUDY OF AUXILIARY AIRBREATHING ENGINES FOR A SPACE SHUTTLE

Gerald A. Kraft and John B. Whitlow, Jr. May 1970 33 p ref

(NASA-TM-X-52810) Avail: CFSTI CSCL 20E

An analytical study was conducted of auxiliary airbreathing engines for a rocket-powered space shuttle. The purpose was to find the theoretical optimum engines. Only turbofans were considered for the booster because of long cruise times. Turbojets and turbofans were considered for the orbiter. The figure of merit was fuel and engine weight per pound of net thrust. Turbofans were about 35 percent better than turbojets for the orbiter. For both stages, hydrogen was about 45 percent better than kerosene. To demonstrate the effect of improvements in engine technology, engine weight was decreased by one-half. This lowered the figure of merit about 20 percent. However, increasing turbine-inlet temperature showed little improvement. Author

N70-27984*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PERFORMANCE OF AN AERODYNAMICALLY POSITIONED AUXILIARY INLET EJECTOR NOZZLE AT MACH NUMBERS FROM 0 TO 2.0

Donald L. Bresnahan Washington May 1970 49 p refs

(NASA-TM-X-2023; E-5536) Avail: CFSTI CSCL 21E

An 8.5-inch model was used with aerodynamically positioned tertiary inlet doors and secondary flaps. The flaps and doors were stable at all power settings and free-stream Mach numbers. Nozzle efficiencies of 0.98 were obtained at takeoff with a nozzle pressure ratio near 3.0, and 0.971 at Mach 2.0 with a nozzle pressure ratio near the design value of 29.0. At subsonic cruise both the nozzle performance and the floating flap position was sensitive to nozzle pressure ratio. For example, at Mach 0.9 increasing pressure ratio from 3.27 to 4.20 increased nozzle efficiency from 0.868 to 0.888 and reduced the nozzle area ratio from 2.93 to 2.38. Author

N70-28055*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.

SUMMARY OF ENGINE CHARACTERISTICS CONSIDERED IN PLUME DEFINITION STUDY

24 Oct. 1968 11 p refs

(Contract NAS8-20082)

(NASA-CR-102683; LMSC/HREC-A791937; TN-54/20-36) Avail: CFSTI CSCL 21H

Exhaust plume characteristics for the R1E, R4D and AJ10-137 rocket engines are being generated for use in determining the effects of plume impingement on the S-IVB Orbital Workshop and associated bodies. Although these engines have been qualified for some time, their nominal operational characteristics are still subject to frequent modifications during the system design phase. Since the process of generating exhaust plume characteristics with real gas and chemistry effects is quite arduous, the calculation of plume data for each engine modification being considered would not be feasible. It is desirable, therefore, to establish a set of "nominal" operating conditions to be used in the generation of the final plume flowfield information. These nominal values are presented along with general information on all engines for which exhaust plume characteristics are being determined. Author

N70-28215# Aro, Inc., Arnold Air Force Station, Tenn.

SUPERSONIC COMBUSTION TESTS WITH A DOUBLE-OBLIQUE-SHOCK SCRAMJET IN A SHOCK TUNNEL Final Report, Jun. 1967 - Dec. 1968

I. T. Osgerby, H. K. Smithson, and D. A. Wagner Feb. 1970 42 p refs

(Contract F40600-69-C-0001)

(AD-700321; AEDC-TR-69-162) Avail: CFSTI CSCL 21/5

Some results of a continuing research program to develop a capability for testing integrated scramjets are reported. During this research program, an integrated double-oblique-shock scramjet model was developed to provide a test bed for supersonic combustion tests and for instrumentation development essential for analysis of combustion test results. Results are presented for tests in which hydrogen fuel was injected into the combustor. Injection of the fuel, from sonic orifices in the wall, normal to the flow did not lead to satisfactory combustion data, supposedly because of the cold boundary layer. Injection through sonic orifices in a series of diamond airfoil injectors led to combustion confirmed by all the following measurements: (1) an increase in static pressure within the combustor downstream of the injection station, (2) an increase in surface heat-transfer rate, (3) an increase in static temperature as measured by the sodium line reversal technique, (4) an increase

in output of radiation sensor gages, and (5) a decrease in flow Mach number inferred from static to pitot pressure measurements. The measured increases were proportionate to increases in computed average equivalence ratio. The combustion results are compared with numerical solutions. In general, the measured temperatures and pressures in the combustor with heat addition were higher than the calculated values. Author (TAB)

N70-28272*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANGULAR DISTRIBUTION OF KAUFMAN ION THRUSTER BEAMS
David C. Byers Washington Jun. 1970 39 p refs
(NASA-TN-D-5844; E-5566) Avail: CFSTI CSCL 21C

A collimating slit system was used to measure the ion beam envelope and thrust direction of a 15-cm-diam electron-bombardment thruster. The angular distribution of the ion beam of five thruster configurations was investigated. The ion beam envelope was found to extend up to about 40 deg half-angle spread for the cases tested. The effect on thrust direction of a transverse grid misalignment was measured and found to compare well with previous experimental and theoretical results. The results of the study were applied to a proposed spacecraft design for a Jupiter flyby mission. Author

N70-28273*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
DYNAMIC ANALYSIS OF XB-70-1 INLET PRESSURE FLUCTUATIONS DURING TAKEOFF AND PRIOR TO A COMPRESSOR STALL AT MACH 2.5
Richard A. Martin Washington Jun. 1970 58 p refs
(NASA-TN-D-5826; H-595) Avail: CFSTI CSCL 21E

Instrumentation in the left inlet of the XB-70-1 airplane was used to record high-response total- and static-pressure data from 0 to 200 hertz during takeoff and immediately prior to a compressor stall at Mach 2.5 and an altitude of 63,100 feet (19,200 meters). Since the statistical assumptions of stationarity, randomness, and normality were found to be approximately valid for the inlet pressure data, random data-analysis techniques were applied. Values of mean turbulence parameter as high as 12 percent were obtained during takeoff and from 14 percent to as high as 31 percent prior to stall. The flight inlet turbulence-producing mechanism, namely, normal-shock boundary-layer interaction, can be simulated successfully in ground test facilities up to at least 40 hertz as evident in the pressure-wave power spectra; however, higher turbulence values were experienced in flight than in model tests by an engine compressor prior to stall. Author

N70-28290*# Hughes Research Labs., Malibu, Calif. Ion Device Physics Dept.
LOW SPECIFIC IMPULSE ION ENGINE Final Report
H. J. King and R. L. Poeschel Feb. 1970 162 p refs
(Contract NAS3-11523)
(NASA-CR-72677) Avail: NASA Scientific and Technical Information Facility, P. O. Box 33, College Park, Md. 20740 CSCL 21C

A 30 cm diameter hollow cathode, mercury electron bombardment ion thruster meeting the general specifications required for prime solar electric propulsion has been developed and tested. The 2.5 kW module operates at an electrical efficiency of 77%, with a mass utilization of 90% (including the plasma bridge neutralizer) at a specific impulse of 2750 sec. The nominal thrust level is 27 mlb. Author

N70-28330*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO 9 MISSION REPORT: SERVICE PROPULSION SYSTEM FINAL FLIGHT EVALUATION, SUPPLEMENT 5
R. J. Smith 4 Aug. 1969 76 p refs Prepared by TRW Systems Group, Houston, Tex.
(Contract NAS9-8166)
(NASA-TM-X-62907; TRW-11176-H311-R0-00) Avail: CFSTI CSCL 21H

Results of the postflight analysis of the Service Propulsion System (SPS) performance during the Apollo 9 Mission are presented. The objective of the analysis was to determine the steady state performance of the SPS under the environmental conditions of actual space flight. Author

N70-28343*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
INVESTIGATION OF A DIGITAL SIMULATION OF THE XB-70 INLET AND ITS APPLICATION TO FLIGHT-EXPERIENCED FREE-STREAM DISTURBANCES AT MACH NUMBERS OF 2.4 TO 2.6
Robert J. Gallagher Washington Jun. 1970 28 p refs
(NASA-TN-D-5827; H-585) Avail: CFSTI CSCL 21E

The capability of a digital inlet simulation program to predict both the performance of the started XB-70 inlet system at free-stream Mach numbers of 2.4 to 2.6 and the dynamic aspects of an inlet unstart at these Mach numbers was analyzed. The simulation-predicted performance was compared with flight measurements, and reasonable agreement was obtained for started and unstarting inlet modes. The agreement between empty-fill (buzz) simulations and flight data was less precise. This was attributed to the need for additional information on the boundary-layer separation process during this mode of inlet operation. The simulation program was used to determine the reaction of the started inlet over a range of performance levels to free-stream temperature gradients in smooth air and in clean air turbulents. Atmospheric temperature variations were found to be nearly as significant as severe turbulence for operation of that type of inlet. Unstart margins for the manually controlled XB-70 inlet in the presence of these disturbances were obtained through use of the simulation program. Author

N70-28617*# Hughes Research Labs., Malibu, Calif.
LM CATHODE THRUSTER SYSTEM Quarterly Progress Report, 4 Jan. 1969 – 4 Apr. 1970
J. Hyman, Jr., J. R. Bayless, J. Simpkins, and J. W. Ward 15 Apr. 1970 30 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952131)
(NASA-CR-110139; QPR-3) Avail: CFSTI CSCL 21C

A 20 cm LM cathode thruster system is being developed that employs a thin-screen high-transparency (70%) ion-extraction system and an LM cathode which is thermally integrated with the thruster body. Assembly of all elements of the system is complete, and optimization-testing is under way. Currently, a beam current of 825 mA is produced with a total source energy per ion of 348 3V/ion at a mass utilization efficiency of 85%. The liquid mercury feed system with its associated power conditioning circuits is now undergoing bell-jar testing prior to integration and testing of the complete thruster system. Thermal analysis demonstrates the capability of the LM cathode thruster to operate in close-packed linear arrays and examines the influence of the external anode connector on thruster operation. Author

N70-28669*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF AN AUXILIARY INLET EJECTOR NOZZLE WITH FIXED DOORS AND SINGLE-HINGE TRAILING-EDGE FLAP
Albert L. Johns and Fred W. Steffen Washington Jun. 1970 61 p refs
(NASA-TM-X-2027; E-5502) Avail: CFSTI CSCL 21E

An auxiliary inlet ejector nozzle applicable to a supersonic-cruise aircraft was evaluated over a range of free-stream

Mach numbers from 0 to 1.20 at appropriate nozzle pressure ratios. Two primary throat areas were used: one to simulate nonreheat operation, and the other for reheat operation. The fixed-geometry shroud was only used in the closed position. The projected boattail area was 47 percent of the simulated nacelle area. Variation in auxiliary inlets included door type (single and double hinge) and values of tertiary flow area (controlled with fixed-position doors) from 0 to 71.5 percent of the shroud exit area. A slightly higher nozzle efficiency was obtained with the double-hinge doors at subsonic-cruise power setting, while the single-hinge doors were a little better at dry-acceleration power setting. At the reheat power setting, the maximum nozzle efficiency was obtained with the doors closed at Mach 0.60 and higher. Author

N70-28736*# Hughes Research Labs., Malibu, Calif. Ion Device Physics Dept.

ION ENGINE THRUST VECTOR STUDY Final Report

Mar. 1970 242 p refs Prepared for JPL

(Contracts NAS7-100; JPL-952129)

(NASA-CR-110155) Avail: CFSTI CSCL 21C

A two part report is presented. The first part describes the results of the analytical portion of a program to establish the expected degree of thrust misalignment in an electric bombardment ion thruster. The analysis includes the probable misalignment that might occur due to mechanical displacement and time, and its effect on the thrust vector. An analysis of mechanical displacement due to thermal and mechanical stresses on the screen and accel electrodes is presented, as is an analysis of the design of thrust stands. The second part describes the hardware portion of the program during which a representative thruster and thrust stand were fabricated, assembled, and tested. A 30 cm, 2 kW thruster was built with an accel electrode that is capable of being mechanically and remotely displaced in the axial, tilted, radial, and translational modes. The thrust stand is capable of resolving the thrust direction to + or − 1/4 deg of angle and torques about the thrust axis of 0.0005 in. lb. Author

N70-29025# National Gas Turbine Establishment, Farnborough (England).

THE DESIGN OF A DIGITAL THREE-TERM CONTROLLER AS A TURBOJET ENGINE SPEED GOVERNOR USING DIGITAL SIMULATION METHODS. PART 1: DIGITAL SIMULATION OF THE DYNAMIC BEHAVIOUR OF A TWO-SPOOL TURBOJET ENGINE. PART 2: A DIGITAL THREE-TERM CONTROLLER AS A TURBOJET ENGINE SPEED GOVERNOR

R. V. Cottington 1970 34 p refs Supersedes NGTE-291; ARC-30103; NGTE-296; ARC-30200

(ARC-R/M-3615; NGTE-291; ARC-30103; NGTE-296; ARC-30200) Copyright. Avail: CFSTI; HMSO; 18s; BIS $3.60

The dynamic behavior of a two-spool turbojet engine can be defined mathematically and thus simulated in a general purpose digital computer. The technique is described together with a brief statement of the mathematical theory. Comparison is made between the behavior of a real engine and that obtained from its digital simulation, and, in general, good agreement is found. A brief discussion of the comparative merits of digital and analog simulation is also presented. A digital three-term controller as a turbojet engine rotor speed governor was investigated on a two-shaft turbojet. The controller logic was programmed into a special purpose digital computer on-line to the engine. A novel way of applying the model reference adaptation technique was used to optimize controller gain settings off-line using a digital simulation for steady state and transient engine behavior. The results from the engine test and the digital simulation are presented. Author (ESRO)

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N70-27918# Universid Mayor de San Andres, La Paz (Bolivia). Lab. de Fisica Cosmica.

HIGH ENERGY NUCLEAR INTERACTIONS OBSERVED AT 5200 m ABOVE SEA LEVEL

Koichi Kamata, Tosiro Maeda, Patrick K. Mac Keown, Carlos Aguirre, Andres Trapp et al 1969 25 p refs Presented at 11th Intern. Conf. on Cosmic Rays, Budapest, 25 Aug.–4 Sep. 1969 Sponsored in part by Bolivian Govt.

(Grant AF-AFOSR-1643-69)

(AD-700435; AFOSR-70-0216TR) Avail: CFSTI CSCL 4/1

High energy nuclear bursts (E>3 x 10 to the 12th power eV) without accompanying air showers are observed at Mt. Chacaltaya (5200 m.a.s.l.), Bolivia. These are supposed to be produced in the shielding material of the BASJE 60 m squared shielded detector by surviving primary protons. The size spectrum of these single bursts is represented by a power function with an exponent -2.4. The energy spectrum of surviving protons in the energy region (3 to 100) x 10 to the 12th power eV) is estimated from the burst spectrum, and is found to be much steeper than the total energy spectrum of primary cosmic rays. Author (TAB)

N70-27947*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

COSMIC RAY RESEARCH AND NUCLEAR INSTRUMENTATION DEVELOPMENT

T. A. Parnell *In its* Radiation Phys. Rev. at MSFC: Res. Achievements Rev., v. 3 1969 p 35-42 refs (See N70-27942 14-24)

Avail: CFSTI CSCL 04A

Three current projects are described as part of a study designed to measure the characteristics of particle populations and illuminate questions involving the origins and temporal stability of trapped radiation belts and the problems in astrophysics related to the origin and transport of galactic cosmic rays. The projects involve instrumentation development and include: (1) a proton spectrometer for the AAP workshop, (2) a large area proportional counter, and (3) a detector system for cosmic ray air showers. The design and characteristics of the instrumentation are presented along with discussions of experimentation conducted. D.L.G.

N70-28003# Applied Systems Corp., Freeport, N.Y.

INVESTIGATION OF ELECTRICAL STRUCTURE IN THE NEAR EARTH REGION AS MEASURED BY ORBITING SPHERICAL ELECTROSTATIC ANALYZERS, OR PLASMA PROBES Final Report, 1 Jul. 1968–31 Oct. 1969

Aaron Lieberman, Benjamin R. Greene, and Warren J. Snapp 28 Nov. 1969 86 p refs

(Contract F19628-68-C-0382)

(AD-700804; AFCRL-70-0017) Avail: CFSTI CSCL 4/1

The report contains a study and analysis of several scientific experiments for the study of the distribution of charged particles in the near Earth regions. The experiments under study consist of Spherical Electrostatic Analyzers or Probes, flown on OGO satellites. Scientific and numerical techniques for the study and analysis of the data produced by these experiments and a system of computer programs for converting the recorded raw data into the desired physical results are given. Author (TAB)

N70-28118*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

WORLD MAPS OF CONSTANT B, L, AND FLUX

CONTOURS
E. G. Stassinopoulos Washington 1970 362 p refs
(NASA-SP-3054) Avail: CFSTI CSCL 04A

A series of world maps showing Gauss(B), Earth radii(L) and J (flux) contours at various heights between the earth's surface and 3000 km above sea level have been produced. Total field intensity, magnetic L-values, and electron and proton fluxes were computed, using the 99-term Hendricks and Cain field expansion for 1960.0, projected to 1965.0. Integral fluxes were calculated with Vette's AE2 electron and AP1-AP4 proton models which describe the trapped radiation environment prior to 1965. The minimum-B equator is included in all maps. It was obtained for each altitude level by tracing the appropriate geomagnetic field lines into space and by determining the position of their equatorial points. Author

N70-28125# Smithsonian Astrophysical Observatory, Cambridge, Mass.
A SEARCH FOR COSMIC SOURCES OF GAMMA RAYS WITH ENERGIES BETWEEN 10 TO THE 11TH POWER AND 10 TO THE 14TH POWER eV
G. H. Rieke (Ph.D. Thesis--Harvard Univ. 25 Jun. 1969 95 p refs Sponsored in Part by NSF
(SAO-Special-Rept-301) Avail: Issuing Activity

CONTENTS:
1. PRODUCTION OF COSMIC GAMMA RAYS IN DISCRETE SOURCES p 3-21 (See N70-28126 14-30)
2. EXPERIMENTS TO SEARCH FOR GAMMA-RAY SOURCES BY DETECTION OF CERENKOV RADIATION FROM AIR SHOWERS p 22-36 (See N70-28127 14-30)
3. THEORETICAL STUDY OF CERENKOV RADIATION FROM AIR SHOWERS p 37-62 (See N70-28128 14-29)
4. EXPERIMENTAL RESULTS p 63-76 (See N70-28129 14-30)

N70-28128# Smithsonian Astrophysical Observatory, Cambridge, Mass.
THEORETICAL STUDY OF CERENKOV RADIATION FROM AIR SHOWERS
In its A Search for Cosmic Sources of Gamma Rays with Energies Between 10 to the 11th Power and 10 to the 14th Power eV 25 Jun. 1969 p 37-62 (See N70-28125 14-29) Avail: Issuing Activity

A Monte Carlo computer program was written to simulate electromagnetic showers. It took account of pair production and bremsstrahlung, Compton scattering, direct pair production by electrons, and ionization loss. The angular distributions of the particles produced through the mechanisms listed above were allowed for approximately. Account was also taken of the variation of the density of the atmosphere with altitude in the calculation of the radial distribution of the particles. Author

N70-28164# Aerospace Corp., El Segundo, Calif. Lab. Operations.
PROPAGATION OF SOLAR PARTICLES TO THE POLAR CAPS, JANUARY-JUNE 1969
George A. Paulikas, J. Bernard Blake, and Alfred L. Vampola 15 Dec. 1969 30 p refs
(Contract F04701-69-C-0066)
(AD-701739; TR-0066(5260-20)-11; SAMSO-TR-70-30) Avail: CFSTI CSCL 4/1

Measurements of solar particles over the polar caps by satellite-borne experiments are summarized. Solar protons down to about 200-keV energy and solar electrons to about 40-keV energy reach the polar caps. In general, solar electrons illuminate the polar caps uniformly during a solar particle event; in contrast, solar proton fluxes exhibit a great deal of spatial structure. Some diffusion of solar protons across the magnetic field is required in order to account for the experimental results. Author (TAB)

N70-28261# Central Research Inst. for Physics, Budapest (Hungary).
INVESTIGATION OF THE 27 DAY PERIODICITY OF THE COSMIC RAY INTENSITY 40 Mwe UNDERGROUND
J. Kota, A. Somogyi, G. Valas, and A. Varga 1 Oct. 1969 4 p refs
(KFKI-26/1969) Avail: AEC Depository Libraries

The existence of a 27-day persistent wave was checked in the intensity of the cosmic-ray muonic component measured at a depth of 40 mwe underground at Budapest during the years 1958 - 1963. The maximum likelihood method with simultaneous meteorological corrections was used to analyze the data. No indication was found for either a 27- or a 27.3-day wave. Author (NSA)

N70-28420*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
DESIGN ENVIRONMENT CRITERIA Final Report
D. N. Vachon, ed. 20 Feb. 1969 47 p refs
(Contract NAS8-21420)
(NASA-CR-102637; GE-9500-ECS-FR) Avail: CFSTI CSCL 04A

The recommended meteoroid flux is given as a function of mass along with an estimate of the uncertainty extremes and the recommended estimate of the penetration depth is given as a function of the penetrating particle flux. Recommended cosmic radiation, solar flare, and trapped radiation environments are given. A static diffusion model of the upper atmosphere is recommended. Solar, albedo, and earth thermal radiation criteria are provided for thermal design of space vehicles. The total field strength of the geomagnetic field is presented. R.B.

N70-28495# Travelers Research Center, Inc., Hartford, Conn.
SOLAR-GEOPHYSICAL FORECAST AIDS AND DECODE PROGRAMS Final Report, Dec. 1967 - Nov. 1969
Lawrence Reed and Isadore Enger Dec. 1969 26 p refs
(Contract F19628-68-C-0096)
(AD-702145; AFCRL-70-0004) Avail: CFSTI CSCL 4/1

The study describes the development of objective aids for predicting flare occurrence and geomagnetic activity and the development of a set of computer programs to decode solar-geophysical codes. The contribution made by magnetic classification and magnetic intensity of sunspots as precursor variables for predicting flare occurrence is investigated. The usefullness of trend analysis is investigated for predicting the geomagnetic planetary index a sub p. Author (TAB)

N70-28571# National Observatory of Athens (Greece). Astronomical Inst.
DYNAMICS OF THE SOLAR CHROMOSPHERE AND ERUPTICE PHENOMENA Final Scientific Report, 1 Jul. 1968 - 30 Jun. 1969
Constantin J. Macris Nov. 1969 42 p refs
(Contract F61052-69-C-0031)
(AD-702147; AFCRL-70-0022) Avail: CFSTI CSCL 3/2

The present paper concerns the following topics: (1) The study of the quality of the H(alpha) filter used for the observations and the determination of its transmission curve. (2) The photometric structure and the evolutive curves of solar flares at several intensity levels were studied. The evolutive curves have been compared with curves obtained from radio observations at several wavelengths. These flares have been photographed at the Observatory of Athens using the 16cm refractor of the triple heliograph. (3) New observational results are given in the work concerning the fine structure and the dynamic phenomena of the solar chromosphere. The research has been made on high resolution photographs of the solar chromosphere, taken with the 40cm refractor of the National Observatory of Athens. Author (TAB)

N70-28574# Milan Univ. (Italy).
OBSERVATIONS ON ELECTRONS IN THE ENERGY RANGE 8 TO 300 MeV
C. J. Bland, G. Degli Antoni, C. Dilworth, D. Maccagni, E. G. Tanzi et al [1969] 19 p refs Presented at the 11th Intern. Conf. on Cosmic Rays, Budapest
(CEA-CONF-1403; CONF-690814-3) Avail: AEC Depository Libraries

Preliminary results obtained with an electron counter on the HEOS A1 satellite (apogee 220,000 km) are presented. The counter is a combination of a gas Cherenkov counter with a shower-detecting telescope. The results discussed cover: (a) flux and energy spectra during the undisturbed period outside the magnetosphere; (b) time variations over the orbital operational period; and (c) correlations with magnetic disturbances. The relation of these observations to the origin of the electrons is investigated. Author (NSA)

N70-28666# Joint Publications Research Service, Washington, D.C.
SPACE IN THE LABORATORY
I. M. Podgornyy *In its* Studies on Space and Spectry., USSR 16 Apr. 1970 p 23-32 (See N70-28664 14-30)
Avail: CFSTI

Investigations conducted on satellites and rockets permit rough classification of solar wind interaction with the earth, moon, and Venus and laboratory modelling of phenomena accompanying such interactions. Shock wave fronts are found in interactions of solar wind with earth and Venus, but no fronts are observed in interactions with the moon. Author

N70-28733*# California Inst. of Tech., Pasadena.
PRIMARY COSMIC-RAY POSITRONS AND NEGATRONS IN 1968 AT ENERGIES BETWEEN 11 AND 204 MeV
Carl James Rice (Ph.D. Thesis) Feb. 1970 176 p refs
(Grant NGL-05-002-007)
(NASA-CR-110192; SRL-70-1) Avail: CFSTI CSCL 04A

The cosmic-ray positron and negatron spectra between 11 and 204 MeV have been measured in a series of high-altitude balloon flights. The detector system consisted of a magnetic spectrometer utilizing a 1000-gauss permanent magnet, scintillation counters, and a lucite Cerenkov counter. Launches were timed so that the ascent through the 100 g/sq cm level of residual atmosphere occurred after the evening geomagnetic cutoff transition. Data gathered during ascent are used to correct for the contribution of atmospheric secondary electrons to the flux measured at float altitude. All flights floated near 2.4 g/sq cm residual atmosphere throughout the nighttime interval. A pronounced morning intensity increase was observed in each flight. Daytime positron and negatron data are presented which support the interpretation of the diurnal flux variation as a change in the local geomagnetic cutoff. Author

N70-28739*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLAR MODULATION OF GALACTIC COSMIC RAYS, 2
L. A. Fisk May 1970 16 p refs Submitted for publication
(NASA-TM-X-63932; X-660-70-180) Avail: CFSTI CSCL 04A

In a galactic cosmic ray model, a Fokker-Planck equation determines the particle number density when the solar wind speed, the diffusion coefficient, and the interstellar cosmic ray spectrum are specified. This equation, however, is difficult to solve analytically. An appropriate numerical technique is outlined, and as examples of the use of this technique, some numerical solutions are presented that provide reasonable fits to observed spectra of protons and helium ions with the assumption of quite simple forms for the diffusion coefficient and unmodulated spectra. Author

N70-28748*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE SPECTRUM OF THE EXTRA-GALACTIC BACKGROUND RADIATION AT LOW RADIO FREQUENCIES
T. A. Clark, L. W. Brown, and J. K. Alexander Jun. 1970 9 p refs Submitted for publication
(NASA-TM-X-63937; X-693-70-210) Avail: CFSTI CSCL 04A

Meter-wave measurements of cosmic noise background radiation are discussed. The brightness of the isotropic component is calculated at about one third the minimum total brightness observed at a frequency of 100 MHz. Explorer-38 satellite measurements of background spectra from 0.5 to 5 MHz averaged over angular regions of approximately 100 deg are combined with ground-based observations adjusted to comparable angular resolution to obtain average spectra from 0.5 to 100 MHz for several different directions including the galactic poles and the anti-center region. R.B.

N70-28798*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INCREASES IN THE LOW ENERGY COSMIC RAY INTENSITY AT THE FRONT OF PROPAGATING INTERPLANETARY SHOCK WAVES
L. A. Fisk May 1970 23 p refs Submitted for publication
(NASA-TM-X-63927; X-660-70-181) Avail: CFSTI CSCL 04A

A simple model is discussed which can account for many of the features observed in the pulse-like increases in the low energy cosmic ray intensity that occur at the front of propagating interplanetary shock waves. It is assumed that low energy particles are swept up by the shock, but because of extensive scattering by magnetic field irregularities remain near the shock front forming the pulse. It is found that the intensity can increase substantially at the shock as particles gain energy by making repeated collisions with the moving shock front. The behavior of particles which accumulate at the shock is illustrated with some solutions to the time-dependent Fokker-Planck equation which governs cosmic ray behavior allowing for convection, diffusion, and particle energy changes. The predicted pulse shapes agree reasonably well with the observations provided that the diffusion coefficient parallel to the magnetic field is approximately 10 to the 19th sq. cm/sec. for 1 MeV protons. Author

N70-28989*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
ON ACCELERATION AND MOTION OF IONS IN CORONA AND SOLAR WIND
Johannes Geiss (Bern Univ.), Peter Hirt (Bern Univ.) and Heinrich Leutwyler (Bern Univ.) Jun. 1969 [illegible] p refs Supported in part by Bern Univ., NRC, and the Swiss NS
(NASA-TM-X-62952) Avail: CFSTI CSCL 03B

Assuming a stationary, radial, spherically symmetric solar wind and a radial magnetic field direction in the vicinity of the sun, an equation of motion for ions heavier than protons in the solar wind is derived. The general properties of this equation are discussed and the results of numerical integrations are given. These results are based on the assumption of maxwellian velocity distribution functions for electrons, protons and ions, but the effects of first order deviations from such distributions are also presented and discussed. It is shown that dynamical friction, i.e. momentum transfer from protons to heavier ions accounts for the observed fact that heavier ions, if accelerated at all, normally reach the same velocity as the protons in the olar wind. Because of the non-linear relation between dynamical friction and proton-ion velocity difference a minimum proton flux is required to carry a certain ion species in the solar wind. Formulas comparing the minimum fluxes for different ions are given. The effects of ion motion and escape on abundances in the corona and in the outer convective zone of the sun are discussed. Author

N70-29007# Genoa Univ. (Italy). Ist. Geofisico e Geodetico.
GLOBAL AND DIFFUSE SOLAR RADIATION AT GENOVA UNIVERSITY AND MONTE CAPELLINO.

JANUARY–DECEMBER 1969
[1970] 51 p In ITALIAN and ENGLISH Sponsored partly by Consiglio Nazl. delle Ric.
Avail: CFSTI

Tables of global and diffuse solar radiation data for the period January to December 1969 from the observations at Genoa University and Monte Capellino, Italy are presented. Author (ESRO)

N70-29042# Universitaets-Sternwarte Goettingen (West Germany).
SOLAR ACTIVITY [SONNENAKTIVITAET]
E. H. Schroeter *In* Deut. Forschungsgemeinschaft Intern. Quiet Sun Yr. (IQSY) 1964/65 1969 5 p refs In GERMAN (See N70-29026 14-13)
Avail: CFSTI

Three German institutes participated in the IQSY solar activity programme which comprised: (1) sunspot counting, spectroheliograms, solar magnetic fields, radio emission, solar X-ray bursts; (2) investigations of the photospheric granulation, solar flares, and solar bursts. ESRO

N70-29043# Max-Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany). Inst. fuer Stratosphaerenphysik.
COSMIC RADIATION [KOSMISCHE STRAHLUNG]
A. Ehmert *In* Deut. Forschungsgemeinschaft Intern. Quiet Sun Yr. (IQSY) 1964/65 1969 3 p In GERMAN (See N70-29026 14-13)
Avail: CFSTI

The galactic cosmic radiation, which penetrates into the solar system is modulated by the solar wind. The nature and extent of this modulation was observed with the aid of several balloon measurements during the IQSY. ESRO

N70-29087# Institut Royal Meteorologique de Belgique, Brussels.
IONOSPHERIC AND COSMIC RAY OBSERVATIONS Monthly Bulletin, Jan. 1970 [OBSERVATIONS IONOSPHERIQUES ET DU RAYONNEMENT COSMIQUE Bulletin Mensuel, Janvier 1970]
1970 31 p In FRENCH and DUTCH
Avail: CFSTI

Ionospheric data tables for January 1970 for Dourbes, Belgium, giving hourly values of the critical, maximum usable, and minimum reflection frequencies, together with the virtual heights of the E and F regions, etc., are presented. Variations of the neutron component intensity of the secondary cosmic radiation are also listed. ESRO

N70-29095# Osservatorio Astrofisico di Arcetri, Florence (Italy).
[SOLAR ACTIVITY OBSERVATIONS AT ARCETRI Annual Report 1968]
Florence Univ. 1968 109 p In ITALIAN *Its* Osservazioni e Mem. Fascicolo 88
Avail: CFSTI

This report lists data obtained at Arcetri (Italy) Astrophysical Observatory in 1968 relating to sunspots, solar radio emission, solar prominences, and other forms of solar activity. ESRO

N70-29178# Centre Scientifique et Technique de la Construction, Brussels (Belgium).
THE STUDY OF HEAT GAINS AND THE NATURAL LIGHTING OF BUILDINGS. PART 1: SOLAR RADIATION [ETUDE DES GAINS DE CHALEUR ET DE L'ECLAIREMENT NATUREL DES BATIMENTS. PREMIERE PARTIE: LE RAYONNEMENT SOLAIRE]
1969 112 p refs In FRENCH *Its* Compt. Rendu d'Etude et de Rech. No. 10
Avail: CFSTI

In order (1) to define the photometric properties of transparent and translucent materials and methods for measuring them, (2) to provide building experts with fundamental data and computation methods for solving technical problems relating to these materials, i.e. solar radiation and the climate in Belgium, and (3) to establish standard methods of computing the heat gain of buildings for determining the cooling power in air conditioning installations, a working group was set up and a manual on solar radiation studies is planned. Luminosity, thermal radiation, insolation, as well as solar radiation and its transmission through the atmosphere are discussed. ESRO

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N70-27839# Sao Paulo Univ. (Brazil). Center of Studies in Celestial Mechanics.
RESEARCH IN CELESTIAL MECHANICS AND DIFFERENTIAL EQUATIONS Annual Technical Report, 15 May–15 Nov. 1969
Giorgio E. O. Giacaglia, Waldyr M. Oliva, Luis N. F. Franca, Nelson Suga, and Sylvio Ursic Nov. 1969 96 p refs
(Contract N00014-67-C-0347)
(AD-702094; CEMC-IMP-USP-69-03; AR-3) Avail: CFSTI CSCL 3/3

The titles of the reports contained in the document are as follows: Orthogonal functions, Literal development of luni-solar perturbation, Motion near sun-perturbed earth-moon collinear equilibrium points, Two centers of libration, Second order functional differential equations, Two dimensional dynamical systems on the plane, and Asymptotic stability and instability of mechanical systems. TAB

N70-27883# Aerospace Corp., El Segundo, Calif. Lab. Operations.
SAGITTARIUS A OBSERVATIONS OF THE GALACTIC CENTER AT 3.3 MM Technical Report, Feb.–Oct. 1969
Michael M. Dworetsky, Eugene E. Epstein, William G. Fogarty, and John W. Montgomery 30 Dec. 1969 23 p refs
(Contract F04701-69-C-0066)
(AD-701379; TR-0066(923004)-1; SAMSO-TR-70-31) Avail: CFSTI CSCL 3/2

Observations at 3.3 mm of the radio source Sagittarius A have been used to obtain a flux estimate. The value is approximately half that predicted by extrapolation of results at longer wavelengths. The mean half-intensity diameter of Sagittarius A appears to be smaller supporting the suggestion of Maxwell and Taylor that the apparent size of Sagittarius A decreases with increasing radio frequency. Author (TAB)

N70-27895# Hawaii Univ., Honolulu. Inst. for Astronomy.
RESEARCH ON THE VELOCITY FIELD OF ACTIVE SOLAR REGIONS Final Report, 1 May 1967–31 Oct. 1969
Richard R. Fisher and Jack B. Zirker Feb. 1970 35 p refs
(Contract N00014-67-A-0387-0001)
(AD-702046) Avail: CFSTI CSCL 3/2

One of the prime objectives of the research program was to develop a new and improved method of recording the Doppler velocity field over two-dimensional solar image. The method is basically an extension of Leightons spectroheliographic technique but employs a closed-circuit TV system in the actual image subtraction process in order to eliminate the complex photographic subtraction employed by Leighton. The basis of the method is described in the report. TAB

N70-27976*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.

ASTROMETRY AND ASTROPHYSICS, NO. 1: PHYSICS OF THE MOON AND PLANETS

I. K. Koval, ed. Washington NASA Apr. 1970 201 p refs Transl. into ENGLISH of the publ. "Astrometriya i Astrofizika, 1, Fizika Luny i Planet" Kiev, Naukova Dumka Press, 1968 (Contract NASw-1692)
(NASA-TT-F-566) Avail: CFSTI CSCL 03B

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4. OPTICAL CHARACTERISTIC OF THE MARS ATMOSPHERE OBTAINED ACCORDING TO CONTRAST MEASUREMENTS I. K. Koval p 58–75 refs (See N70-27980 14-30)

5. THE NATURE OF THE POLAR CAPS OF MARS I. K. Koval et al p 76–90 refs (See N70-27981 14-30)

6. THE EFFECT OF ATMOSPHERIC VIBRATION ON THE BRIGHTNESS DISTRIBUTION OVER THE DISK OF A PLANET I. K. Koval et al p 91–118 refs (See N70-27982 14-30)

7. THE METHANE ABSORPTION DISTRIBUTION IN THE 6190 A BAND OVER THE DISK OF JUPITER V. V. Avramchuk p 119–151 refs (See N70-27983 14-30)

8. DISTRIBUTION OF METHANE ABSORPTION IN THE 6190 A BAND OVER THE DISK OF SATURN IN 1966 V. V. Avramchuk p 153–155 refs (See N70-27984 14-30)

9. THE PROBLEM OF DIFFUSE REFLECTION OF MONOCHROMATIC RADIATION E. G. Yanovitskiy p 156–168 refs (See N70-27985 14-30)

10. BRIGHTNESS COEFFICIENTS OF A HOMOGENEOUS PLANE LAYER OF A TURBID MEDIUM E. G. Yanovitskiy p 169–177 refs (See N70-27986 14-30)

11. COUNT RATE METER (CRM) O. I. Bugayenko p 178–182 (See N70-27987 14-14)

12. AN ELECTROPHOTOMETER FOR LOW LUMINOUS FLUXES L. A. Bugayenko et al p 183–199 refs (See N70-27988 14-14)

N70-27977*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.

A PHOTOMETRIC METHOD OF LUNAR TOPOGRAPHY

L. R. Lisina *In its* Astrometry and Astrophys., No. 1 Apr. 1970 p 1–32 refs (See N70-27976 14-30)
Avail: CFSTI CSCL 03B

The photometric characteristics of the Moon scattering light are described. It is shown that, in determining the brightness of lunar details according to theoretical formulas, the macroslope must be considered. Small slopes are determined by the photometric method. The photometric method of determining the slopes for observations of the lunar surface from a spacecraft is discussed. The requisite parameters are calculated in order to determine the slopes and heights of the thalassoid Korolev on the far side of the Moon. From the photographs obtained by the Soviet spacecraft Zond-3, the thalassoid Korolev is a basin surrounded by numerous rings with faults. Author

N70-27978*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.

STRUCTURAL CHARACTERISTICS OF SOME CRATERS ON THE FAR SIDE OF THE MOON

M. N. Mironova *In its* Astrometry and Astrophys., No. 1 Apr. 1970 p 33–45 refs (See N70-27976 14-30)
Avail: CFSTI CSCL 03B

The profiles of 29 craters on the far side of the Moon are reviewed. The photographs obtained by the automatic interplanetary station Zond-3 were used. The photometric method of investigating the lunar surface was applied, and the method of obtaining the profiles of craters from lunar photographs taken from a spacecraft is described. The size and form of the lunar craters on the far side are similar to those on the near side. The depth-to-diameter ratios obtained for the craters under investigation are the same as those assumed for the eruptive craters. The older craters have greater dimensions and depths and look like a cup. Younger craters have inner shapes in the form of the frustum of a cone. It appears that the crater formations on the far and near sides of the Moon are the same. Author

N70-27979*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.

HEIGHT PROFILES OF TWENTY-NINE CRATERS ON THE FAR SIDE OF THE MOON

M. N. Mironova *In its* Astrometry and Astrophys., No. 1 Apr. 1970 p 46–57 (See N70-27976 14-30)
Avail: CFSTI CSCL 03B

The profiles of 29 craters on the far side of the Moon are shown. The photometric method was used in obtaining these crater profiles. An analysis of the results is given. Author

N70-27980*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.

OPTICAL CHARACTERISTICS OF THE MARS ATMOSPHERE OBTAINED ACCORDING TO CONTRAST MEASUREMENTS

I. K. Koval *In its* Astrometry and Astrophys., No. 1 Apr. 1970 p 58–75 refs (See N70-27976 14-30)
Avail: CFSTI CSCL 03B

Photometric data on the contrasts between the highlands and maria of Mars, measured in different spectral regions, are analyzed. The optical parameters of the Mars atmosphere are determined. Some assumptions on the behavior of the true constrast over the spectrum are made. The results show that the model of the scattering atmosphere with optical thickness of approximately 0.2 at 0.43 micron is in good agreement with the observations. Author

N70-27981*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.

THE NATURE OF THE POLAR CAPS OF MARS

I. K. Koval et al *In its* Astrometry and Astrophys., No. 1 Apr. 1970 p 76–90 refs (See N70-27976 14-30)
Avail: CFSTI CSCL 03B

Data are given on the change in size of the polar caps of Mars with the heliocentric longitude, according to photographic and visual observations. The structure and nature of the polar caps are discussed on the basis of long-term photometric investigations. The amount of water on Mars is estimated. The substance forming the polar caps is assumed to be concentrated on the Mars surface, and seems to be a discontinuous layer of snow with neutral albedo equal to 0.8. This assumes that the layer of snow occupies approximately 25% of the area of the cap. Using a value of 2 cm for the thickness of the snow layer, the amount of precipitable water is found to be equal to 0.005-0.05 g/sq cm. Author

N70-27982*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.

THE EFFECT OF ATMOSPHERIC VIBRATION ON THE BRIGHTNESS DISTRIBUTION OVER THE DISK OF A PLANET

I. K. Koval et al *In its* Astrometry and Astrophys., No. 1 Apr. 1970 p 91–118 refs (See N70-27976 14-30)
Avail: CFSTI CSCL 03B

The problem of making corrections is discussed for the distortions in the brightness distribution observed along the disk

of the planet because of atmospheric vibration. The effect of the width of the slit used in determining the vibrational disk on the atmospheric vibration (instrumental function) is estimated for the case when the latter is a Gaussian function. It is shown that a rather narrow slit does not effect the instrumental function. Whether or not the distortions involved are stationary is also discussed. Detailed tables are given for the brightness distribution observed when the true distribution is known. Author

N70-27983*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
THE METHANE ABSORPTION DISTRIBUTION IN THE 6190 A BAND OVER THE DISK OF JUPITER
V. V. Avramchuk *In its* Astrometry and Astrophys., No. 1 Apr. 1970 p 119-115 refs (See N70-27976 14-30)
Avail: CFSTI CSCL 03B

The results of measurements of the methane absorption in the 6190 A band along the disk of Jupiter are given. The data were taken from 52 spectrograms, which were obtained in 1964-66 with the aid of a 70-cm reflector (F sub eff = 30 m) with a diffraction spectrograph attached (dispersion of 30 A/mm). It is shown that the value of the methane absorption for the center of the disk of Jupiter changed during different periods of observations. The greatest variations in intensity of absorption are found for longitudes of 190-320 deg. The equivalent widths W sub b and depths R sub b of the 6190 A band are smaller for the edge zones of the Jupiter disk than for the center. The difference between the equivalent widths is 5-6 A. The variations change substantially from the edges to the center. Author

N70-27984*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
DISTRIBUTION OF METHANE ABSORPTION IN THE 6190 A BAND OVER THE DISK OF SATURN IN 1966
V. V. Avramchuk *In its* Astrometry and Astrophys., No. 1 Apr. 1970 p 153-155 refs (See N70-27976 14-30)
Avail: CFSTI CSCL 03B

Some results are given of an analysis of five spectrograms of Saturn obtained with the aid of a 70-cm reflector attached to a diffraction spectrograph (dispersion of 30 A/mm) in August of 1966. It is shown that, during the period of observations, the absorption in the 6190 A methane band was stable at the center of the Saturn disk, and equal to 25-27 A. At the same time, the polar regions showed substantial variations. During the observation period, the equivalent width for the 6190 A band decreased from 32-33 to 25-26 A. Author

N70-27985*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
THE PROBLEM OF DIFFUSE REFLECTION OF MONOCHROMATIC RADIATION
E. G. Yanovitskiy *In its* Astrometry and Astrophys., No. 1 Apr. 1970 p 156-168 refs (See N70-27976 14-30)
Avail: CFSTI CSCL 03B

The problem of the diffuse reflection of monochromatic radiation by a semi-infinite plane layer of a medium, with isotropic scattering, is discussed. A recurrence formula is obtained in order to calculate the terms in the expansion of the Ambartsumyan function phi(n,gamma) for powers of z = square root of (1-gamma,) where gamma is the albedo of the particles for single scattering, gamma(n,1) is assumed to be known. The case of the simplest nonspherical indicatrix of scattering is discussed. Author

N70-27986*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
BRIGHTNESS COEFFICIENTS OF A HOMOGENEOUS PLANE LAYER OF A TURBID MEDIUM
E. G. Yanovitskiy *In its* Astrometry and Astrophys., No. 1 Apr. 1970 p 169-177 refs (See N70-27976 14-30)
Avail: CFSTI CSCL 03B

Three types of equations determining the Ambartsumyan phi and psi functions are obtained for the case when the indicatrix of scattering proves to be a finite number of terms in an expansion into a series by Legendre polynomials. Linear relationships connecting the cited functions are obtained. Author

N70-27996*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS OF BROKEN PLANE TRAJECTORIES FOR THE PIONEER F MISSION
Fred Teren Washington May 1970 21 p refs
(NASA-TM-X-2024; E-5574) Avail: CFSTI CSCL 22C

A study was conducted to determine if broken plane trajectories can be used to increase the duration of the Pioneer-F launch opportunity, or equivalently, to increase payload capability for a fixed launch opportunity duration. Optimum single conic and broken plane trajectories are calculated for the launch day-trip time combinations, and minimum trip time trajectories (for a given payload mass) are determined for each launch date. The maximum mass of spacecraft propellant required for the broken plane trajectories is calculated. Then, new minimum trip time trajectories are calculated in which the added spacecraft propellant mass is optimally utilized for all launch days. Launch opportunity duration is determined as a function of spacecraft mass for the single conic and broken plane opportunities. Values of launch vehicle injection hyperbolic velocity and declination are presented, along with values of optimum spacecraft propellant mass and correction time. The results show that the use of broken plane trajectories can provide a small increase in launch opportunity duration and/or spacecraft mass. Author

N70-28061# Liege Univ. (Belgium). Dept. of Astrophysics.
CELESTIAL SPECTRA AND ATMOSPHERIC EFFECTS MAINLY IN THE INFRARED Final Report, 1 Jun. 1966-15 Jul. 1969
Marcel V. Migeotte 7 Nov. 1969 141 p refs
(Contract AF 61(052)-955)
(AD-702159; AFCRL-70-0023) Avail: CFSTI CSCL 3/2

Contents: Improvements introduced in the Jungfraujoch solar spectrometer and tests of this installation; List of solar spectra taken between 4999 A and 7610 A, specially observed in view of a new solar atlas; List of publications, since 1966, based on Jungfraujoch data; Detailed report on a balloon gondola developed to observe the solar spectrum, under high resolving power, for wavelengths longer than 1.5 microns, at an altitude above 25 Km. Report of the first flight (June 6, 1969 - Palestine, Texas - U.S.A.). Author (TAB)

N70-28084*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CRYSTALLINE ROCKS FROM MARE TRANQUILLITATIS: PRELIMINARY PETROLOGIC INFERENCES
Paul D. Lowman, Jr. Dec. 1969 21 p refs
(NASA-TM-X-63916; X-644-69-550) Avail: CFSTI CSCL 03B

Preliminary petrographic studies were made of two crystalline rock samples returned from Mare Tranquillitatis by the Apollo 11 mission, and a discussion of their petrologic implications is presented. Sample 10017 is a finegrained vesicular Type A rock with the following volumetric composition: clinopyroxene, 49.7%; plagioclase, 18.0%; ilmenite and other opaques, 23.9%; interstitial material, 8.3%; and traces of an unidentified mineral. Sample 10047 is a coarser-grained non-vesicular holocrystalline Type B rock with the following composition: clinopyroxene, 49.9%; plagioclase, 32.5%; ilmenite and other opaques, 15.2%; cristobalite, 2.5%. Neither sample showed any evidence of shock. The samples appear representative of the Apollo 11 samples in general and at least locally of the Mare Tranquillitatis bedrock. The crystalline rocks are deduced to be true igneous rock, formed from internally-generated magma, rather than impact melts. The magma is believed to have been primary, and very hot, dry, and fluid by terrestrial standards.

The rocks chemically resemble titanium-rich pyroxene gabbros from the Adirondack anorthosite complex. Their petrology implies that the interior of the Moon went through a high temperature stage (1300 deg to 1500 C) very early in its history. Author

N70-28126# Smithsonian Astrophysical Observatory, Cambridge, Mass.
PRODUCTION OF COSMIC GAMMA RAYS IN DISCRETE SOURCES
In its A Search for Cosmic Sources of Gamma Rays with Energies between 10 to the 11th Power and 10 to the 14th Power eV 25 Jun. 1969 p 3 - 21 (See N70-28125 14-29)
Avail: Issuing Activity CSCL 90

Compton scattering, bremsstrahlung, and decay of mesons are considered in terms of producing detectable fluxes of high energy gamma rays from discrete celestial objects. Absorption is considered only in terms of interpreting the results for quasi-stellar objects, if the sources are at cosmological distances. J.M.C.

N70-28127# Smithsonian Astrophysical Observatory, Cambridge, Mass.
EXPERIMENTS TO SEARCH FOR GAMMA-RAY SOURCES BY DETECTION OF CERENKOV RADIATION FROM AIR SHOWERS
In its A Search for Cosmic Sources of Gamma Rays with Energies Between 10 to the 11th Power and 10 to the 14th Power eV 25 Jul. 1969 p 22 - 36 (See N70-28125 14-29)
Avail: Issuing Activity

The characteristics of experiments to search for celestial sources of gamma rays by detecting Cerenkov light from cosmic ray air showers are considered. The searchlight system and 10-m reflector are described. J.M.C.

N70-28129# Smithsonian Astrophysical Observatory, Cambridge, Mass.
EXPERIMENTAL RESULTS
In its A Search for Cosmic Sources of Gamma Rays with Energies between 10 to the 11th Power and 10 to the 14th Power eV 25 Jun. 1969 p 63 - 76 (See N70-28125 14-29)
Issuing Activity

Experimental results obtained with the searchlight system are tabulated. Fifteen possible sources were scanned; in addition, the location of CP 0950 near Leo XR-1 permitted an upper limit to be obtained for the former from reexamination of the drift scans on the latter. The effect of the difference between the shower rate when the source was in the field of view of the detectors and the average shower rate when the source was outside the field is considered with the quoted error as the standard deviation of the difference. J.M.C.

N70-28148*# Bellcomm, Inc., Washington, D.C.
MULTIPLE SCATTERING CALCULATION FOR PLANETARY ATMOSPHERES
E. N. Shipley 15 May 1970 38 p refs
(Contract NASw-417)
(NASA-CR-110006; TM-70-1014-2) Avail: CFSTI CSCL 03B

An iterative technique for calculating the multiple scattering effect in planetary atmospheres has been developed. Various studies have been conducted to insure the accuracy of the technique and of the computer programs which carry out the calculations. The technique, while intended for a spherical geometry, can be adapted to a planar geometry, for which exact calculations are available through the method developed by Chandrasekhar. Comparisons of the apparent brightness were made for a haze model which had been developed previously to explain the photometric results of Mariner IV. For the planar geometry, the iterative technique produces results which agree with the exact calculations to better than 1/2%. For the spherical geometry, it was found that the effect of multiple scattering was to increase the apparent brightness by about 20% when the line of sight intersected the surface, and by up to a factor of two when the line of sight lies above the limb of the planet. It is concluded that the iterative technique provides an accurate method of calculating multiple scattering effects in planetary atmospheres. Author

N70-28221*# Bellcomm, Inc., Washington, D.C.
A MECHANISTIC VISUALIZATION OF THE SUN-EARTH-EARTH ORBITAL PLANE SYSTEM
J. W. Powers 31 Mar. 1970 31 p refs
(Contract NASw-417)
(NASA-CR-110007; TM-70-1022-10) Avail: CFSTI CSCL 03A

A simplified mechanistic model of the sun-earth-earth orbital plane system is presented. In this model the earth orbital plane simultaneously revolves about the lateral surface and rotates about the vertex of an inertially oriented right circular cone. The cone also revolves about a fixed point with uniform circular velocity with its vertex in a plane. Equations are developed for the angles between the orbital and ecliptic planes and between the orbital plane and solar vector. General sun angle envelopes for both date and time of launch are described. By consideration of appropriate angles in the cone base, the times from orbital insertion to angular extreme between the orbital plane and solar vector are determined. Use of the model facilitates visualization of the many significant parameters of earth-orbital space flight mechanics without use of coordinate transformations. Author

N70-28238*# Bellcomm, Inc., Washington, D.C.
ORBIT DETERMINATION FOR LUNAR PARKING ORBITS USING TIME-VARYING ORBITAL ELEMENTS
M. V. Bullock and A. J. Ferrari 7 May 1970 27 p refs
(Contract NASw-417)
(NASA-CR-110008; TR-70-310-2) Avail: CFSTI CSCL 22C

A lunar orbit determination program (Osculating Lunar Elements Program - OLEP) has been developed that represents perturbed vehicle motion by time-varying orbital elements. The program estimates perturbing effects of noncentral gravity anomalies, so the concept does not rely on any assumed lunar gravity model. Doppler tracking data from the lunar orbits of Lunar Orbiter III, Apollo 8, 10, 11, and 12 missions have been processed, and the results are presented. The solutions obtained from these data show OLEP to be effective for use in lunar navigation and orbit prediction. A comparison between OLEP and one current standard technique, shows OLEP propagation errors smaller by a factor of 2.5 or more. This concept shows potential for application to future Apollo missions and to deep space missions involving planets whose gravity fields are not well known. Author

N70-28239*# Bellcomm, Inc., Washington, D.C.
A PHYSICAL MODEL OF APOLLO OXYGEN RELEASES
A. C. Buffalano 29 Apr. 1970 17 p refs
(Contract NASw-417)
(NASA-CR-110009; TM-70-1011-3) Avail: CFSTI CSCL 03B

During the Apollo 8 lunar flight, 3300 kilograms of liquid oxygen were released from the S-4B 45,000 kilometers from the earth during a normal mission operation. The oxygen froze immediately forming a large (500 km) cloud of small particles. The cloud was photographed by the Smithsonian Astrophysical Observatory's satellite tracking station in Spain over a 90 minute period. We have reduced this photometric data using a simple collisionless model for the expansion and have deduced the following parameters. The particles which are responsible for the scattering have a bulk velocity of 1.4 × 10(4) cm/sec and a thermal velocity of .3 × 10(4) cm/sec. While we are unable at this time to estimate the radius of the scatterers with any confidence, a lower bound of one micron was established. Author

N70-28244*# Bellcomm, Washington, D.C.
THE TEMPERATURE AND SIZE HISTORIES OF LIQUID H2, O2, and H2O PARTICLES RELEASED IN SPACE

A. C. Buffalano and R. D. Sharma 6 Mar. 1970 29 p refs
(Contract NASw-417)
(NASA-CR-110083; TR-70-105-5-1) Avail: CFSTI CSCL 03B

Micron-size droplets of liquid H2, O2, and H2O released in space during normal operations on Apollo lunar missions quickly freeze and reach equilibrium where the loss of energy from sublimation and emission of radiation just equals the absorption of radiation that is incident from the earth and the sun. For H2 and O2 the emission of radiation is negligible compared to sublimation but for H2O it is very important and increases particle lifetimes significantly. Typically, at an altitude of 400 miles, where the earth is an important infrared source, sunlit particles decrease in radius with e-folding times of 15 (H2), 120 (O2), and 1200 (H2O) secs. In cislunar space these times increase roughly by an order of magnitude. The accuracy of the results for H2 and O2 is limited by experimental uncertainties in the imaginary part of the index of refraction for these materials. Author

N70-28252*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
GOETHITE ON MARS: A LABORATORY STUDY OF PHYSICALLY AND CHEMICALLY BOUND WATER IN FERRIC OXIDES
James B. Pollack, Douglas Pitman, Bishun N. Khare, and Carl Sagan 15 May 1970 40 p refs
(Grants NGR-09-015-023; NGL-33-010-082)
(NASA-CR-109892; SAO-Special-Rept-314) Avail: CFSTI CSCL 03B

A thermogravimetric analysis of the decomposition of goethite-rich samples of limonite and measurement of the equilibrium vapor pressure of the water physically bound in the sample are performed. The heats of sorption for the physically bound component are determined; an activation energy of 29 + or - 3 cal/mole is found between 225 and 390 C. The results imply that physical sorption will tend to take place preferentially over condensation. This tends on Mars to inhibit the formation of a water polar cap. The atmospheric water-vapor pressure should vary with the seasons because of the temperature dependence of physical sorption. Since the amount of this variation seems to be in accord with the spectroscopic observations, an alternative exists to the hypothesis that the greater water-vapor partial pressure in the spring hemisphere indicates meridional transport of water vapor and an ice polar cap. Because of their superior topographical resolution, spacecraft correlations of temperature and water-vapor abundance seem to be the most promising tool for establishing whether sorption or condensation controls the seasonal and topographical variations in the atmospheric water-vapor content. Author

N70-28286*# Texas Univ., Austin. Engineering Mechanics Research Lab.
NUMERICAL ERROR COMPARISONS FOR INTEGRATION OF NEAR EARTH ORBITS IN VARIOUS COORDINATE SYSTEMS
Oliver Albert Schwausch Jan. 1968 77 p refs
(Grant NGL-44-012-008)
(NASA-CR-110005) Avail: CFSTI CSCL 22C

The sensitivity of two body states obtained through numerical integration to coordinate system and integration step size is investigated for various orbit types. This is accomplished by numerically integrating the equations of two-body motion for the various coordinate systems and then comparing resulting states to the states generated through the two-body solution. By holding one parameter constant and varying the other two, the effect of each of the integrated states can be determined. It is observed that for all coordinate systems investigated, step size has a greater influence on the error than the orbit shape. It can also be observed that the position and velocity error curves behave in similar manner. Finally, any operation designed to reduce the errors in position also reduces the errors in velocity. Author

N70-28534*# National Aeronautics and Space Administration, Washington, D.C.
SPACE FLIGHT HANDBOOKS. VOLUME 3: PLANETARY FLIGHT HANDBOOK. PART 9: DIRECT AND VENUS SWINGBY TRAJECTORIES TO MERCURY
1970 238 p refs Prepared by Gen. Dyn./Ft. Worth, Tex.
(Contract NAS2-4982)
(NASA-SP-35-Vol-3-Pt-9) Avail: SOD $2.25; CFSTI CSCL 22C

This handbook contains trajectory data and related information for (one-way) direct flyby and Venus swingby missions to Mercury in the period 1973–1985. Author

N70-28589*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
FIRST ORDER PERTURBATIONS OF AN ORBIT BY A MASS ANOMALY
David E. Smith Mar. 1970 21 p refs Submitted for publication
(NASA-TM-X-63921; X-550-70-85) Avail: CFSTI CSCL 22C

The first order short period perturbations of a satellite's position and the first order long period perturbations of the orbital elements by a mass anomaly are developed. It is shown that the maximum values of the secular and long period perturbations are about 300 and 80 meters in the along track and across track directions per revolution for a mascon of .00001 of the moon's mass. In addition, short period perturbations were found with maximum amplitudes of about 15 meters in height, 40 meters in along track position, and 7 meters in the across track direction. The major assumptions made in the analysis were that the position of the mascon and the orbit of the spacecraft remained fixed in space over the integration period (one revolution). The former approximation can be justified because the moon rotates very slowly and the latter approximation is valid if the perturbations by all other forces are small, which is usually the case. Author

N70-28647# Grumman Aircraft Engineering Corp., Bethpage, N.Y. Research Dept.
A SUMMARY OF CURRENT TECHNIQUES IN LUNAR SCIENTIFIC INVESTIGATIONS: AN AID TO MISSION EVALUATION AND PLANNING
Edward A. Nowatzki Apr. 1970 80 p refs
(RM-474) Avail: CFSTI

A technique for the evaluation of the scientific accomplishments of the Apollo missions is extended and improved. This is accomplished by the development of two tables which are cross-referenced and related to the earlier-developed evaluation techniques through the 26 scientific questions posed by the Space Science Board. The tables present information such as current methods of approach, instrumentation, etc., pertinent to the answering of each question. An example reevaluation of one of the scientific questions is given to demonstrate the impact of the present work. Recommendations are made for future developments, extensions, and applications of the improved technique. Author

N70-28651*# IIT Research Inst., Chicago, Ill. Astro Sciences Center.
THE ROLE OF SUBSATELLITES IN THE EXPLORATION OF THE MOON
P. J. Dickerman Jan. 1970 49 p refs
(Contract NASw-1861)
(NASA-CR-110186; P-33) Avail: CFSTI CSCL 03B

The need for Apollo CSM subsatellite orbiters as a subset of a broader class of lunar orbiters is considered. The basis of the evaluation is the orbital science measurements which should be performed in the exploration of the moon. Consideration is given to all modes of investigation except photography. A subsatellite is defined as a spacecraft which initially is incorporated in the service module, which is released in or into lunar orbit, and which can function completely independent of the service module. Its complexity may range from a simple beacon to a large automated spacecraft and the relevance of subsatellites over this whole range is considered. Author

N70-28664# Joint Publications Research Service, Washington, D.C.
STUDIES ON SPACE AND SPECTROSCOPY, USSR
16 Apr. 1970 34 p Transl. into ENGLISH from Priroda (Moscow), Feb. 1970 p 8–19 and 61–65
(JPRS-50336) Avail: CFSTI

CONTENTS:
1. SPECTROSCOPY AND ASTROPHYSICS S. L. Mandelshtam p 1–22 (See N70-28665 14-30)
2. SPACE IN THE LABORATORY I. M. Podgornyy p 23–32 (See N70-28666 14-29)

N70-28665# Joint Publications Research Service, Washington, D.C.
SPECTROSCOPY AND ASTROPHYSICS
S. L. Mandelshtam *In its* Studies on Space and Spectry., USSR 16 Apr. 1970 p 1–22 (See N70-28664 14-30)
Avail: CFSTI

Experiments in obtaining and investigating spectra of highly ionized atoms are discussed with respect to astrophysics and cosmic spectroscopy. Identification of emission lines of the sun from satellite and rocket data is compared with laboratory experiments in which lasers are used to determine spectra of solids. R.B.

N70-28672*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MIE SCATTERING CALCULATIONS OF THE CONTRIBUTION OF ATMOSPHERIC AEROSOLS TO THE MARTIAN OPPOSITION EFFECT
Jaylee Montague Mead (Ph.D. Thesis—Georgetown Univ.) Jun. 1970 84 p refs Submitted for publication
(NASA-TM-X-63926; X-641-70-170) Avail: CFSTI CSCL 03B

The Mie theory is used to compute the integrated scattering intensities for spherical submicron aerosol particles with various indices of refraction and several size distributions in an effort to determine if the presence of atmospheric aerosols can account for the Martian opposition effect, as observed by O'Leary and by Koval' in 1967. This nonlinear surge in brightness, as the planet approaches a phase angle of 0 deg, is reported to be much more pronounced in the ultraviolet than in the infrared. The calculations show that neither substances having a refractive index n between 1.20 and 1.50, which include ice, water, and solid CO2, nor highly absorbing materials, such as limonite, can produce the oppositon effect. On the other had, aerosols having n > or = to 1.50 with little or no absorption, such as meteoric particles or suspended surface dust composed of semitransparent minerals, do exhibit a definite increase in reflectivity at small phase angles. Author

N70-28682*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GEOLOGIC ANALYSES OF SELECTED APOLLO 10 70 mm LUNAR AND TERRESTRIAL PHOTOGRAPHS
H. W. Blodget, P. D. Lowman, Jr., and J. A. O'Keefe Apr. 1970 26 p refs Submitted for publication
(NASA-TM-X-63925; X-644-70-165) Avail: CFSTI CSCL 03B

Geologic analyses of selected Apollo 10 70 mm photographs taken during translunar coast, lunar orbit, and transearth coast are presented. Photographs of sinuous and nonsinuous rilles in Mare Tranquillitatis and north-eastern Sinus Medii reveal X-shaped intersections and segments of rilles crossing hills, suggesting a basically tectonic rather than fluid flow origin. Detailed photographs of highland craters on the moon's far side show mass wasting that appears to have occurred by continuous flow, rather than in discrete slump blocks, which indicates a deep noncohesive fragmental layer for such areas. Other photographs show mare ridges capped by higher albedo hills that are apparently younger than the ridges, and which are thus suggested to be volcanic extrusions from the ridges. Several nearly vertical photographs of Mare Smythii taken with high sun angles show dark centered craters with bright walls, which may be of internal origin. The color of the earth's surface can be seen with relatively little atmospheric distortion from distances of 30,000 miles or more, and enables recognition of a great amount of topographic detail in North Africa, southwest Asia, and North America. Brief descriptions of the major physiographic features visible on selected earth photographs are presented. Author

N70-28689# Joint Publications Research Service, Washington, D.C.
APERTURE SYNTHESIS IN RADIO ASTRONOMY
N. M. Tseytlin 29 Apr. 1970 33 p refs Transl. into ENGLISH from Radiotekhn. i Elektron. (Moscow), no. 3, 1970 p 427–449
(JPRS-50419) Avail: CFSTI

Certain general characteristics of the Ryle system, the Mills and Christiansen crosses, variable-base interferometers, of compound and multi-element interferometers are analyzed, representing specific cases of aperture synthesis. The main attention has been directed to the spectral (in respect to spatial frequencies) characteristics of the antena systems. Author

N70-28716*# RAND Corp., Santa Monica, Calif.
OBSERVATIONS OF THE 1969 INFERIOR CONJUNCTION AND GREATEST WESTERN ELONGATION OF VENUS: DATA CATALOG AND PRELIMINARY ANALYSIS
G. E. Kocher, G. F. Schilling, R. C. Moore, and M. Turner Mar. 1970 82 p refs
(Contract NASw-1782)
(NASA-CR-110180; RM-6262-NASA) Avail: CFSTI CSCL 03B

A catalog of telescopic and photometric information on Venus is presented. Two specific celestial phenomena were investigated: inferior conjunction (April 3 to 22) and greatest western elongation (June 14 to 21). The latter was observed simultaneously from observatories some eleven degrees apart in longitude. Along with each photographic observation, many of which were in daylight or twilight, photometer readings of the sky, near Venus and elsewhere, were recorded. This program was the observational follow-up of a theoretical study that suggested that the Venus cusp extension angle measured was dependent on the brightness of the terrestrial sky around it. Now it is suggested that additional factors also play a role, factors associated with the earth's atmosphere and with the characteristics of the observing equipment. The interplay of two parameters, sky brightness and film exposure time, is examined. Author

N70-28728*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TYPE III SOLAR RADIO BURST STORMS OBSERVED AT LOW FREQUENCIES. PART 1: STORM MORPHOLOGY
Joseph Fainberg and R. G. Stone May 1970 24 p refs Submitted for publication
(NASA-TM-X-63934; X-615-70-188) Avail: CFSTI CSCL 03B

Storms of type 3 solar radio bursts observed from 5.4 to 0.2 MHz indicate the quasi-continuous production of type 3 events observable for a half solar rotation but persisting in some cases for well over a complete rotation. The characteristics of these storms, including the dependance of occurrence and apparent drift rates on the disc position of the associated active region, are discussed. The drift rate dependance is shown to be a consequence of the propagation time of emission from the source to the observer. The occurrence rate of a burst every 10 seconds observed near CMP implies that if this level of activity persists, then about a quarter of a million exciter packets are released into the interplanetary plasma during a complete rotation. Storm bursts are less intense than most isolated type 3 bursts and occur over a more limited frequency range. There appears to be a very close relation between these storms and decametric continuum. Author

N70-28783*# IIT Research Inst., Chicago, Ill. Astro Sciences Center.

OBJECTIVES OF PERMANENT LUNAR BASES

W. K. Hartmann and R. J. Sullivan Jan. 1970 76 p refs

(Contract NASw-1861)

(NASA-CR-110187; P-32) Avail: CFSTI CSCL 22A

The advantages and disadvantages of permanent lunar orbiting and surface bases are examined. Lunar and nonlunar scientific uses of the bases are described, and details are given on measurement techniques. It is concluded that from a scientific point of view there is no strong justification for a manned orbital base; orbital science can be satisfactorily performed by unmanned satellites. It is felt that man's capacity to understand, investigate, and discover phenomena make a manned surface base mandatory for lunar exploration and exploitation. N.E.N.

N70-28784*# IIT Research Inst., Chicago, Ill. Astro Sciences Center.

LUNAR SURFACE SCIENTIFIC EXPERIMENTS AND EMPLACED STATION SCIENCE

W. K. Hartmann 9 Mar. 1970 61 p

(Contract NASw-1861)

(NASA-CR-110200; P-31) Avail: CFSTI CSCL 22A

The relation of science stations (of the ALSEP type) to the total conglomerate of lunar science is summarized. A comprehensive list of scientific objectives and measurement techniques from which to draw the experiments and fit them to the various landing sites is determined. The different phases of lunar exploration and the specific type-sites and experiments to be considered for each are discussed. Emphasis is on Apollo and the immediate post-Apollo period, though orbital and permanent surface base operations are considered. The experiments, the sites, and the rationale of lunar research are established and the surface science experiments are selected and ranked according to importance for Apollo and for post-Apollo missions. The possible needs for remote unmanned landers, unmanned and manned rovers, and flying units are considered. Manned rovers and flying units are found most useful. Author

N70-28785*# IIT Research Inst., Chicago, Ill. Astro Sciences Center.

CRITERIA FOR LUNAR SITE SELECTION

A. B. Binder and D. L. Roberts Jan. 1970 47 p refs

(Contract NASw-1861)

(NASA-CR-110199; P-30) Avail: CFSTI CSCL 22A

The basic framework for lunar exploration is that Apollo missions will visit sites that are representative of the major provinces of the moon and will have as a principal function, the collection of samples from the regions visited. A brief critique of the selected Apollo sites is included and within the context stated above, seven of the ten sites conform extremely well. The criticism of the other three, site 5 (recycle), Rima Bode II, and Descartes is that they are too complex to allow unambiguous interpretation of the collected samples. The principle task is to understand the individual processes that have operated on the moon over its lifetime. Type sites containing features that are unambiguously representative of individual processes are listed. The requirements for adequate exploration of each type site (such as the staytime, number of mean and lunar science specialists require, and the extent of mobility) are defined. Author

N70-28786*# IIT Research Inst., Chicago, Ill. Astro Sciences Center.

LOGIC FOR LUNAR SCIENCE OBJECTIVES

Jan. 1970 124 p refs

(Contract NASw-1861)

(NASA-CR-110179; P-29) Avail: CFSTI CSCL 22A

Basic lunar scientific objectives and measurement techniques are outlined. Four levels of exploration are identified: overall reconnaissance; sampling of representative systems; determination of feature-related processes; and comprehensive, regional exploration and exploitation. The overall correlation of objectives, techniques, and exploration levels is considered, and a priority list of measurement techniques is given. A greater role for the CSM in obtaining orbital data is recommended. N.E.N.

N70-28787*# United Aircraft Corp., East Hartford, Conn. Research Labs.

A METHOD FOR THE DETERMINATION OF OPTIMAL MULTIPLE-IMPULSE RENDEZVOUS TRAJECTORIES Final Report

J. R. Doll Feb. 1970 51 p refs

(Contract NAS8-24440)

(NASA-CR-110195; J-970850-7) Avail: CFSTI CSCL 22C

A new method for calculating optimal time-fixed multiple-impulse rendezvous trajectories in a three-dimensional, inverse-square gravity field is developed. The method consists of applying the finite difference Newton – Raphson algorithm, extended to handle parameter optimization, to the nonlinear system of equations describing the optimum trajectory. In the problem formulation, the magnitudes and timing of the impulses are treated as parameters for optimization. The equations which describe Lawden's necessary conditions for an optimal impulsive trajectory are used to couple the parameters to the system of state and adjoint equations. Two methods are investigated for generating starting solutions for the multiple-impulse trajectory optimization routine developed, namely, the variable-thrust solution and the two-impulse solution. Both methods are utilized successfully in various test cases, and results are presented documenting the validity of each. Author

N70-28788*# Maryland Univ., College Park. Dept. of Physics and Astronomy.

THE DETECTOR PACKAGE FOR THE LUNAR RANGING EXPERIMENT AT McDONALD OBSERVATORY. SUPPLEMENT 2: INTERPRETATION OF STAR MEASUREMENTS AND OTHER SUPPLEMENTARY ITEMS

S. K. Poultney 12 Dec. 1969 7 p refs Submitted for publication

(Grant NGR-21-002-109)

(NASA-CR-110209; TR-957-B) Avail: CFSTI CSCL 03B

Daily star measurements are tabulated, and system configurations are recorded for interpretation. A nominal factor of four used to convert measurements with a 0.7 A filter and to compare them with 3 A filter measurements is presented, along with an absolute counting rate calculation of red magnitudes. J.A.M.

N70-28816*# RAND Corp., Santa Monica, Calif.

VENUS CUSP OBSERVATIONS DURING 1969: SYNOPSIS OF RESULTS

G. F. Schilling, G. E. Kocher, R. C. Moore, and M. Turner Mar. 1970 51 p refs

(Contract NASw-1762)

(NASA-CR-110191; RM-6261-NASA) Avail: CFSTI CSCL 03B

The principal results of this investigation were threefold: (1) The planetocentric extension of the Venus twilight zone was found to average 5 deg, implying that the effectively scattering atmosphere extends to an average height of 20 to 25 km above the opaque cloud deck. (2) The discrepancy in the occurrence of dichotomy was verified, although the curtailment of the observing period prevented an exact determination. (3) The apparent cusp extension angle had been theoretically determined to be a function of sky brightness. This was verified observationally, and was found to be related to exposure time as well. The occurrence of a maximum in this angle depends on a combination of the two parameters. Although further theoretical analysis of this phenomenon is necessary before a complete explanation can be given, a

relationship now exists that may yield a terrestrial technique for deriving the brightnesses of portions of a planet's atmosphere as if seen from space. Values of surface brightness for selected areas of the sky corroborate those of some twenty years ago, suggesting little change in the atmospheric aerosol content. Author

N70-28859# Aix-Marseilles Univ. (France).
APPLICATION OF PHOTOGRAPHIC INTERFERENCE METHODS TO THE STUDY OF THE SPIRAL STRUCTURE OF THE GALAXY [APPLICATIONS DES METHODES INTERFERENTIELLES PHOTOGRAPHIQUES A L'ETUDE DE LA STRUCTURE SPIRALE DE LA GALAXIE]
Yvon P. Georgelin (Ph.D. Thesis) Nov. 1969 222 p refs In FRENCH
Avail: CFSTI

Six thousand independent radial velocities in the H 2 regions of the Milky Way reveal the Local, Perseus, Sagittarius, and Norma (Rule)-Centaureus spiral arms. Velocity and distance measurements give data on the solar motion, the terms A and alpha of the galactic rotation, and the kinematic distances. The H2 region diameters show the galaxy to be of the Sc-type, and photometric analyses are in agreement with the 21 cm model recently proposed. ESRO

N70-28870*# Bureau of Mines, Minneapolis, Minn. Twin Cities Mining Research Center.
MULTIDISCIPLINARY RESEARCH LEADING TO UTILIZATION OF EXTRATERRESTRIAL RESOURCES Quarterly Status Report, 1 Jan. –1 Apr. 1970
1 Apr. 1970 27 p
(NASA Order R-09-040-001)
(NASA-CR-110193) Avail: CFSTI CSCL 22A

Progress in studying properties of simulated lunar rocks are reported. The torsional shear apparatus assembly was completed and a series of earth atmosphere tests was run on basalt powder simulating the fine lunar soil matrix in preliminary studies to determine the effects on fine particles. Drilling with the ultrahigh vacuum apparatus to determine surface properties of rocks and minerals was continued. Results of compression tests on dacite and basalt in ultrahigh vacuum, fabric analysis, and anisotropy studies are described. Initial tests were made on the infrared radiometer to determine thermophysical properties of rocks. The large high vacuum facility for research on explosives is being constructed. Efforts to prepare oxygen by electrolysis of silicate-fluoride melts, and processing Apollo lunar surface and sample data are also mentioned. N.E.N.

N70-28873# Royal Aircraft Establishment, Farnborough (England).
UPPER-ATMOSPHERE ROTATIONAL SPEED AND ITS VARIATION WITH HEIGHT
D. G. King-Hele, Diana W. Scott, and Doreen M. C. Walker Nov. 1969 34 p refs
(RAE-TR-69263) Copyright. Avail: CFSTI

The average rotational speed of the upper atmosphere can be determined by analysing the changes in the orbital inclinations of satellites. This procedure was applied to eleven new orbits to give values of lambda, the ratio of atmospheric angular velocity to the earth's angular velocity, at heights between 250 and 380 km. When these new results are combined with 21 previous values, the variation of lambda with height can be determined over a much wider height range than was previously possible, namely from 200 to 400 km. It was found that lambda increases from about 1.1 at 200 km height to about 1.35 at 300 km, and about 1.45 at 400 km. This implies that the wind is, on average, from west-to-east, with its mean speed increasing from 40m/s at 200 km height to 180 m/s at 400 km (for latitudes near 30 deg). There is no evidence that lambda varies from year to year or with solar activity. Author (ESRO)

N70-28903# Milan Univ. (Italy). Ist. di Fisica.
ESTIMATES OF THE GAMMA RAY FLUX FROM SAGITTARIUS A
Laura Maraschi, Massimo Tarenghi, and Aldo Treves 1970 17 p refs
Avail: CFSTI

Analysis of the anisotropy for the gamma ray background observed by Clark suggests that part of the anisotropy may be due to a source at the galactic center. The complex structure of the radio and infrared emission of the region of Sgr A is considered. The gamma ray flux arising from Compton scattering and neutral pion decay is calculated. For a value of the magnetic field H approximately 0.0001 Gauss, corresponding to equipartition, the gamma ray flux above 100 MeV at the earth from the Sgr A source is expected to lie between 0.000001 and 0.00001 gamma/sq cm sec. Such a source should be detectable in the near future. Author (ESRO)

N70-28926# Addis Translations International, Woodside, Calif.
PLUTO AND TRANS-PLUTO
W. Strubell Dec. 1969 8 p refs Transl. into ENGLISH from Die Sterne (West Ger.), v. 29, no. 5-6, 1953 p 111–113
Prepared for UCRL Lawrence Radiation Lab.
(UCRL-Trans-10433) Avail: CFSTI

Problems involved in the computation of the orbit of a trans-Plutonian planet are discussed. The main difficulty in the calculation is that the mass and diameter of Pluto are not accurately known. The existence of a trans-Pluto has been assumed from the presence of a family of eight comets between 75 and 89 AU. This family of comets could have been produced by the yet unobserved trans-Plutonian planet, and thus provide further indications of the possibility of its existence. A.L.

N70-28962# Mons Univ. (Belgium). Dept. d'Astrophysique.
POSITIONAL UNCERTAINTIES IN THE SMITHSONIAN 'STAR CATALOG' IN ECLIPTIC COORDINATES
E. Blondelot Jan. 1970 8 p refs /*ts* Commun. No. 9
Avail: CFSTI

This note examines all error sources and final accuracies in ecliptic latitude and longitude arising from conversion of the Smithsonian 'star catalog' to ecliptic coordinates for the epoch 1970 using an IBM 7040 computer. Author (ESRO)

N70-28966*# Bellcomm, Inc., Washington, D.C.
A SECONDARY EJECTA EXPLANATION OF A LUNAR SEISMOGRAM
G. K. Chang, P. Gunther, and D. B. James 17 Mar. 1970 35 p refs
(Contract NASw-417)
(NASA-CR-110079; TM-70-2015-2) Avail: CFSTI CSCL 03B

The seismograph recording of the Apollo 12 LM impact is studied as the result of a spray of secondary ejecta around the seismometer. A theoretical study of the ballistic trajectories, plausible angular distributions and seismic signals to be expected from such a spray was made. Secondary ejecta cannot account for signals arriving earlier than 45 seconds, but could explain the remaining portion of the signal provided that the angular distribution of the secondary ejecta are assumed to peak sharply in the vertical direction. Hence, it is concluded that one can neither prove nor disprove the hypothesis that a substantial portion of the signal is due to secondary ejecta. Author

N70-29022*# Hawaii Inst. of Geophysics, Honolulu.
ELASTIC PROPERTIES OF THE LUNAR SURFACE FROM SURVEYOR SPACECRAFT DATA Final Report
George H. Sutton and Frederick K. Duennebier 11 May 1970 22 p refs
(Contract NAS7-100; JPL-952208)

(NASA-CR-110132) Avail: CFSTI CSCL 03B

Elastic properties and seismic velocities of the upper few centimeters of the moon, as calculated from Surveyor data, are compared with results obtained from Apollo. Author

N70-29093# Paris Observatory, Meudon (France).
SYNOPTICAL MAPS OF THE SOLAR CHROMOSPHERE AND CATALOGS OF THE FILAMENT AND ACTIVITY CENTERS, VOLUME 5, PART 1, 1966–1967 [CARTES SYNOPTIQUES DE LA CHROMOSPHERE SOLAIRE ET CATALOGUES DES FILAMENTS ET DES CENTRES D'ACTIVITE, VOLUME 5, FASCICULE 1, 1966–1967]
1968 85 p In FRENCH
Avail: CFSTI

Tabulated data of solar rotations covering filaments and centers of activity. Transl. by J.M.C.

N70-29097# Observatoire de Marseille (France).
CONTRIBUTION OF INTERFERENCE METHODS TO THE PHYSICS OF EMISSION NEBULAE [CONTRIBUTION DES METHODES INTERFERENTIELLES A LA PHYSIQUE DES NEBULEUSES D'EMISSION]
R. Louise (Ph.D. Thesis—Aix-Marseilles Univ.) 14 Jan. 1970 193 p refs In FRENCH
Avail: CFSTI

Theoretical studies of the excitation and emission mechanisms in the H 2 region are reviewed, and the parameters which can be measured are analysed. Methods for assessing electron temperatures in a nebula, which makes no assumptions concerning its physical state, and evaluating the abundance of nitrogen are described. Interferometric methods were used to study the kinematic and physical state of the Helix (NGC 7293) nebula. ESRO

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N70-27830# Aerospace Corp., San Bernardino, Calif. Technology Div.
A DISCUSSION AND ANALYSIS OF SOME ASPECTS OF TRANSPIRATION COOLED NOSETIPS Technical Report, Jun.–Sep. 1969
R. A. Gater 22 Oct. 1969 50 p refs
(Contract F04701-69-C-0066)
(AD-702435; TR-0066(S5816-36)-1; SAMSO-TR-70-80) Avail: CFSTI CSCL 13/1

Transpiration cooling of a porous nosetip of a hypersonic reentry vehicle employing water as a coolant is considered. Fundamental problem areas are discussed, and those requiring considerably more analytical and/or experimental investigation are noted. Analysis and example calculations are presented for the local rate of mass transfer from the liquid surface film to the proximate gas stream. Particular emphasis is placed upon evaluating the relative importance of the mass transfer contributions due to evaporation from an idealized smooth film surface, additional evaporation due to the effective roughness of the film surface; and entrainment of bulk liquid from the film surface due to shear interaction with the gas flow. Correspondingly, computed results for downstream cooling effectiveness are presented for hypersonic reentry type flow conditions. In addition, analyses are developed and example calculations are presented for film surface temperature, mean film thickness, and mean film surface velocity. Finally, some specific recommendations are made for future research effort. Author (TAB)

N70-27842# Aerospace Corp., El Segundo, Calif. Lab. Operations
DETECTION OF TITAN POGO CHARACTERISTICS BY ANALYSIS OF RANDOM DATA Technical Report, Aug. 1963–Jul. 1969
R. G. Wagner and S. Rubin 9 Feb. 1970 54 p refs
(Contract F04701-69-C-0066)
(AD-701377; TR-0066(5305)-3; SAMSO-TR-70-22) Avail: CFSTI CSCL 22/4

Dynamic characteristics of Titan vehicles related to the Pogo phenomenon were found through the analysis of low-level random accelerations and pressures from ground test and flight data. Natural frequencies of vibration of propellant suction lines and of flight vehicle longitudinal motion have been successfully detected from locations of peaks in auto spectra. The inflight performance of a standpipe accumulator has been evaluated by means of both auto-spectral and cross-spectral analyses. An anomalous occurrence of Pogo vibration on one flight was explained by the analysis as due to a lack of normal gas charge in the standpipes. A new method is applied to the evaluation of the longitudinal structural dynamic model of the vehicle. The method involves the detection of node frequencies at locations of accelerometers. Author (TAB)

N70-27989*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRACKING AND DATA SYSTEM SUPPORT FOR LUNAR ORBITER
J. R. Hall 15 Apr. 1970 198 p refs
(Contract NAS7-100)
(NASA-CR-109875; JPL-TM-33-450) Avail: CFSTI CSCL 22B

CONTENTS:

1. LUNAR ORBITER PROJECT SUPPORT p 1–40 (See N70-27990 14-07)
2. LUNAR ORBITER 1 p 41–58 (See N70-27991 14-31)
3. LUNAR ORBITER 2 p 59–83 (See N70-27992 14-31)
4. LUNAR ORBITER 3 p 85–107 (See N70-27993 14-31)
5. LUNAR ORBITER 4 p 109–129 (See N70-27994 14-31)
6. LUNAR ORBITER 5 p 131–154 (See N70-27995 14-31)

N70-27991*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LUNAR ORBITER 1
In its Tracking and Data System Support for Lunar Orbiter 15 Apr. 1970 p 41–58 (See N70-27989 14-31)
Avail: CFSTI CSCL 22B

Lunar Orbiter 1's mission to search for suitable landing sites for the Apollo project is described, along with lunar gravitational harmonics data obtained during high lunar orbit. Acceptable long lifetime low orbits for lunar photography were determined. Selenodetic measurements were continued through the end of the mission. J.A.M.

N70-27992*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LUNAR ORBITER 2
In its Tracking and Data System Support for Lunar Orbiter 15 Apr. 1970 p 59–83 (See N70-27989 14-31)
Avail: CFSTI CSCL 22B

Lunar Orbiter 2 photographic information along the northern latitude band was analyzed for possible lunar landing sites for Apollo and Surveyor spacecraft. A survey of the impact area of Ranger 8 was included. Precision trajectory data for lunar gravitational harmonics were obtained, along with micrometeroid flux and radiation dose measurements of the lunar environment. Preflight tests, near-earth and deep space operations and performances are summarized. J.A.M.

N70-27993*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LUNAR ORBITER 3
In its Tracking and Data System Support for Lunar Orbiter 15 Apr. 1970 p 85-107 (See N70-27989 14-31)
Avail: CFSTI CSCL 22B

Lunar Orbiter 3 designed for confirmation of landing sites examined in the two previous missions is described. Precision trajectory data for lunar grivitational harmonics, micrometeroid flux and radiation dose measurements of the lunar environment, and evaluation of the MSFN tracking network and Apollo determination program are reviewed. J.A.M.

N70-27994*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LUNAR ORBITER 4
In its Tracking and Data System Support for Lunar Orbiter 15 Apr. 1970 p 109-129 (See N70-27989 14-31)
Avail: CFSTI CSCL 22B

Lunar orbiter mission 4 is described performing a broad systematic photographic survey of the lunar surface as a basis for landing site selection for subsequent missions. Trajectory data for lunar gravitational harmonics, micrometeoroid flux and radiation dose measurements, and MSFN tracking performance are evaluated. J.A.M.

N70-27995*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LUNAR ORBITER 5
In its Tracking and Data System Support for Lunar Orbiter 15 Apr. 1970 p 131-154 (See N70-27989 14-31)
Avail: CFSTI CSCL 22B

Lunar orbiter 5 photography of near and far sides of moon and supplemental photography of candidate Apollo landing sites are evaluated. Precision trajectory data for lunar gravitational field, micrometeroid flux and radiation dose measurements of the lunar environment, and MSFN tracking network performance are reviewed in near earth and deep space operations. J.A.M.

N70-28054*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
FORCES DUE TO A COMMAND SERVICE MODULE REACTION CONTROL MOTOR PLUME IMPINGING ON THE SATURN 5 CLUSTER ARRANGEMENT DRY WORKSHOP VERSION
M. M. Penny Aug. 1969 33 p refs
(Contract NASB-20082)
(NASA-CR-102686; LMSC/HREC-D149170; TM-54/20-231)
Avail: CFSTI CSCL 22B

The results of an analytical investigation to determine the impingement characteristics for six cases of an RCS motor located on the SM being fired for attitude control are presented. These impingement characteristics represent the highest loadings to be expected when the CSM is in the docked position. It is to be noted that an infinite number of positions from which an attitude control motor might be fired are described as the envelope of possible docking trajectories, some of which might possibly represent higher panel loadings than presented. Author

N70-28071# Aerospace Corp., El Segundo, Calif. Lab. Operations.
SHOCK TUNNEL SIMULATION OF SURFACE PRESSURE FLUCTUATIONS ON TITAN 3 MODELS Technical Report, Jan. 1965 - Jan. 1967
David H. Ross 1 Oct. 1969 49 p refs
(Contract F04701-68-C-0066)
(AD-702169; TR-0066(9240-02)-2; SAMSO-TR-70-53) Avail: CFSTI CSCL 22/4

An experimental investigation in The Aerospace Corporation low-speed shock tunnel was conducted for determination of the fluctuating pressure levels on the surface of Titan III models. This novel employment of the shock tunnel permits rapid and low-cost model testing and thus assists in the prediction of booster-vehicle acoustic environment. The configurations tested were 1:30 scale models of the Titan IIIA (cone-cylinder core only) and the Titan IIIC with both 120- and 156-in.-diam solid rocket motor boosters attached to the core. The electrical signals from the high-frequency, flush-mounted pressure transducers were digitized and then spectrally analyzed by a digital computer. The resulting model spectra were scaled for comparison with flight data on the basis of dynamic pressure q and Strouhal frequency fD/U. Author (TAB)

N70-28130*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRACKING AND DATA SYSTEM SUPPORT FOR THE PIONEER PROJECT. VOLUME 2: PIONEER 7. PRELAUNCH TO END OF NOMINAL MISSION
N. A. Renzetti 15 Apr. 1970 207 p refs
(Contract NAS7-100)
(NASA-CR-109870; JPL-TM-33-426-Vol-2) Avail: CFSTI CSCL 22B

CONTENTS:

1. TRACKING AND DATA SYSTEM SUPPORT FOR THE PIONEER PROJECT. VOLUME 2: PIONEER 7. PRELAUNCH TO END OF NOMINAL MISSION: INTRODUCTION p 1-15 (See N70-28131 14-31)

2. PIONEER 7 TDS REQUIREMENTS p 15-32 (See N70-28132 14-31)

3. PIONEER 7 TDS CONFIGURATION p 32-77 (See N70-28133 14-31)

4. PIONEER 7 PREFLIGHT TEST PROGRAM p 77-84 (See N70-28134 14-31)

5. PIONEER 7 TDS FLIGHT SUPPORT p 84-130 (See N70-28135 14-31)

6. PIONEER 7 TDS PERFORMANCE EVALUATION p 130-187 (See N70-28136 14-31)

N70-28131*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRACKING AND DATA SYSTEM SUPPORT FOR THE PIONEER PROJECT. VOLUME 2: PIONEER 7. PRELAUNCH TO END OF NOMINAL MISSION: INTRODUCTION
In its Tracking and Data System Support for the Pioneer Project, Volume 2 15 Apr. 1970 p 1-15 (See N70-28130 14-31)
Avail: CFSTI CSCL 22B

The Pioneer 7 mission to record characteristics of magnetic fields, plasma, and high-energy particles in interplanetary space is discussed. The tracking and data system, launch vehicle, spacecraft, and scientific instrumentation are described. R.B.

N70-28132*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PIONEER 7 TDS REQUIREMENTS
In its Tracking and Data System Support for the Pioneer Project, Volume 2 15 Apr. 1970 p 15-32 (See N70-28130 14-31)
Avail: CFSTI CSCL 22B

The Tracking and Data System near-earth phase support for Pioneer 7 consisted of the Air Force Eastern Test Range, the Goddard Space Flight Center, and portions of the Deep Space Network. The tracking and data acquisition coverage requirements of the tracking facilities are discussed with respect to the mission, launch vehicle, and range safety requirements. Author

N70-28133*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PIONEER 7 TDS CONFIGURATION
In its Tracking and Data System Support for the Pioneer Project, Volume 2 15 Apr. 1970 p 32-77 (See N70-28130 14-31)
Avail: CFSTI CSCL 22B

Near-earth support for the Pioneer 7 mission was based on trajectory data and requirements. The metric system consisting of optical instruments and C-band radars and the data flow which supports the early launch phase are described. The deep space instrumentation, ground communications, and spaceflight operations facilities for the deep space portion of the mission are discussed. R.B.

N70-28134*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PIONEER 7 PREFLIGHT TEST PROGRAM
In its Tracking and Data System Support for the Pioneer Project, Volume 2 15 Apr. 1970 p 77–84 (See N70-28130 14-31)
Avail: CFSTI CSCL 22B

The preflight review, AFETR prelaunch testing operations, and the Deep Space Network tests are described for the Pioneer 7 space probe. The S-band telemetry for Pioneer 7 was also tested for compatibility. R.B.

N70-28135*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PIONEER 7 TDS FLIGHT SUPPORT
In its Tracking and Data System Support for the Pioneer Project, Volume 2 15 Apr. 1970 p 84–130 (See N70-28130 14-31)
Avail: CFSTI CSCL 22B

Near-earth support activities from prelaunch through the nominal mission are summarized. Deep space support is provided by the various deep space tracking facilities and certain tracking stations equipped with Pioneer ground operational equipment command the spacecraft to perform desired maneuvers and operations. R.B.

N70-28136*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PIONEER 7 TDS PERFORMANCE EVALUATION
In its Tracking and Data System Support for the Pioneer Project, Volume 2 15 Apr. 1970 p 130–187 (See N70-28130 14-31)
Avail: CFSTI CSCL 22B

Performance evaluation of the near-earth phase included tracking, S-band telemetry, VHF telemetry, the real-time computer system, communications, radar coverage, and data handling. The main objectives of the deep space phase were to acquire the spacecraft S-band signals for determining orbit parameters, to acquire continuous telemetry information, and to furnish all tracking and data acquisition services for orbit correction and flight maneuvers. R.B.

N70-28231*# Bell Aerosystems Co., Buffalo, N.Y.
APOLLO RCS POSITIVE EXPULSION TANKAGE PRODUCT IMPROVEMENT PROGRAM. TASK B: LONG TERM COMPATIBILITY TESTING Final Report, Jul. 1967–Sep. 1969
12 Nov. 1969 90 p
(Contract NAS9-7182)
(NASA-CR-108456; BAC-8514-928004) Avail: CFSTI CSCL 22B

The useful operating life was determined of the current Apollo and LM RCS tank configurations applicable to an extended duration mission with a specific test requirement for a 12-month storage period with propellant at operating pressure and temperature. Particular aspects of the current tank configurations which were thought could be affected by extended storage with propellant were: (1) Creep of the titanium tank shell; (2) Integrity of the external tank flange seal with respect to possible cold flow of the teflon gasket and subsequent loss of bolt torque; and (3) Possible degradation of bladder material because of prolonged exposure to propellant. In addition, long term compatibility of N_2O_4, MMH and 50/50 fuel blend with the combination of materials in the tank assemblies was verified. Author

N70-28335*# Bellcomm, Inc., Washington, D.C.
SUPPORT MOTION INDUCED VIBRATIONS OF AN ORBITING CASSEGRAIN TELESCOPE
P. G. Smith 17 Mar. 1970 43 p refs
(Contract NASw-417)
(NASA-CR-110093; TM-70-1022-3) Avail: CFSTI CSCL 22B

A structural model of a Cassegrain space telescope is developed to determine structural deformation and associated optical degradation resulting from motions of a supporting spacecraft. Three specific designs, a 1 meter f-30, a 1 meter f-60, and a 2 meter f-60, are investigated using the modal, which represents the basic structure, mirrors, detailed mirror mountings, and an experiment package. All three designs retain their diffraction-limited performance when excited by deterministic representations of astronaut motion disturbances or by worst case control system disturbances. Special attention is given to the coordinates used in order to obtain good numerical accuracy. Also, a means for determining the amount of error in the results is presented. Further investigation is suggested to determine the deformation due to random crew motion representations as well as the effect of the telescope attitude control system on deformation. Author

N70-28416*# Honeywell Inc., Minneapolis, Minn. Systems and Research Center.
STUDY OF ASTRONAUT'S ABILITY TO DETECT STARS THROUGH A CONTAMINATED SPACECRAFT WINDOW Final Report, 1 Jul. 1969–1 Jan. 1970
Roger P. Heinisch and R. N. Schmidt May 1970 156 p
(Contract NAS2-5015)
(NASA-CR-73445) Avail: CFSTI CSCL 22B

The objective of this investigation was to predict the star magnitude which can be seen with the naked eye or a sextant telescope through a contaminated spacecraft window. The effects of geometry and outgassing conditions were studied. In addition, a relative comparison was made between laboratory contaminated windows and a small specimen flown on an Apollo flight. The results indicate that the RTV560 used to seal the windows severely contaminates the window by outgassing. High-temperature-cured RTV560 is much worse in that respect than room-temperature-cured RTV560. In general, it is evident that, using a telescope or the naked eye, an astronaut will have difficulty seeing usual navigational stars under background conditions caused by light scattered from the contaminated windows studied in this program. Author

N70-28488# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
RESEARCH ON DYNAMICS OF FLIGHT VEHICLES Final Technical Report
P. C. Hughes Jan. 1970 25 p
(Grant AF-AFOSR-1490-68)
(AD-702138; AFOSR-70-0558TR) Avail: CFSTI CSCL 22/2

Brief summaries are given of research carried out on the following topics: Optimum transient riddance in damped linear systems; Geometrical properties in state space of linear differential equations with periodic coefficients; Performance and stability of hypervelocity aircraft flying on a minor circle; The use of strings and wires in gravity-gradient satellite configurations; Reference/text Dynamics of Atmospheric Flight; Dynamics of rods with damping hinges; Rapid numerical determination of the instantaneous orientation of a rigid body. Author (TAB)

N70-28602# Joint Publications Research Service, Washington, D.C.
INTERKOSMOS-1 SATELLITE IN ORBIT
Igor Pavlovich Tindo et al 4 Jun. 1970 22 p refs Transl. into ENGLISH from Priroda (USSR), no. 4, 1970 p 78–87
(JPRS-50659) Avail: CFSTI

The flight of the Interkosmos-1 satellite for study of solar flare phenomena is discussed. The instrumentation on board the satellite, which includes an X-ray photometer, a Lyman-alpha photometer, an X-ray polarimeter, and an optical photometer, is described. Simultaneous optical and radio observations are being carried out at ground solar observatories for comparison with telemetric data from the satellite. R.B.

N70-28627# Radio and Space Research Station, Slough (England).
CATALOGUE OF ROCKET AND SATELLITE DATA IN WORLD DATA CENTRE C, 1 JULY–31 DECEMBER 1969
Jul. 1969 33 p
Avail: CFSTI

Flight information summaries are presented for satellite and rocket launchings during the second half of 1969. The summaries are arranged according to date of launch and country of origin.
R.B.

N70-28943*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACE PROGRAMS SUMMARY NO. 37-62, VOLUME 1 FOR THE PERIOD 1 JANUARY TO 28 FEBRUARY 1970. FLIGHT PROJECTS
31 Mar. 1970 52 p refs
(Contract NAS7-100)
(NASA-CR-110091; JPL-SPS-37-62-Vol-1) Copyright. Avail: CFSTI CSCL 22A

Progress in the Mariner Mars 1971 program and the Viking project is described. For the Mariner, instrument analysis of TV subsystem included breadboard models and flowchart diagrams. A bipropellant propulsion module, a beryllium truss structure, and a flight cabling system were designed and/or modified. Thermal resistance at chassis-subchasis interface, static loads, longitudinal low frequency environmental vibrations, and metallurgical parameters of burst propellant vessels were tested. The gas chromatograph-mass spectrometer of the Viking project to Mars was tested. The effects of propellant slosh dynamics on Viking orbiter powered flight control were formulated. The power subsystem, attitude control, propulsion structure, S-band antenna, and temperature control subsystems were modified. S.S.

N70-29014# Louisiana Univ., Baton Rouge. Coll. of Engineering.
AN AIR TO SURFACE MISSILE SIMULATION USING A DIGITAL SIMULATION LANGUAGE
G. D. Whitehouse, Mario Calude, and A. J. Mc Phate Nov. 1969 90 p refs
(Contract F44620-68-C-0021; Proj. Themis)
(AD-702087; Themis-LSU-T-TR-33) Avail: CFSTI CSCL 16/2

A six degree of freedom air to ground missile simulation is developed utilizing a digital simulation language. The simulation incorporates all aerodynamic coefficients and missile characteristics to completely describe missile performance over various flight regimes. Development of the simulation is done in modular form wherever possible to increase the flexibility and to cause a more general simulation. A typical flight regime is given using data for a particular missile and the results indicated a miss distance of 7 feet from a launch position of nearly 30 miles away. All miss distances appear to be less than the Circular Error Probable for the missile in the cases attempted. The digital simulation language used in the simulation affords an efficient and simplified method for the dynamic modeling of a complex missile system. The program could be extended to other systems both air to air and ground to air without undue difficulty. Author (TAB)

N70-29020# Laboratoire de Recherches Balistiques et Aerodynamiques, Vernon (France).
DEVELOPMENT AND FINANCING PLAN FOR STAGE L 120 OF THE ELDO LAUNCH VEHICLE [PLAN DE DEVELOPPEMENT ET DE FINANCEMENT DE L'ETAGE L 120 DU LANCEUR ELDO]
Heidmann, Muller, and Simon 16 Oct. 1969 192 p In FRENCH
(Contract ELDO-17/3/63)
(NT-76/69/SEN/SY) Avail: CFSTI CSCL 22B

A two part study of the development and financing of the L-120 stage of the ELDO launch vehicle is presented. The first part of the study outlines the justification for the program with emphasis on the theoretical development of guidance and propulsion system equipment. The second part of the study concentrates on a detail analysis of cost estimations and financing.
Transl. by J.M.C.

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N70-27815# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
CREEP ANALYSIS OF SQUARE PLATES
David Ranlet Dec. 1969 23 p refs
(Contract F44620-69-C-0072)
(AD-700442; PIBAL-69-48; AFOSR-69-3003TR) Avail: CFSTI CSCL 20/12

The report presents an analysis of the creep bending of simply-supported, thin, square plates subjected to uniform lateral pressure. The analysis is based upon a creep power law and an analogy between the problem of creep and the corresponding nonlinear elastic problem. An approximate solution, which in general requires a numerical evaluation, is obtained by means of Reissners variational principle. Graphical results are presented for the transverse displacements, bending moments, and twisting moment corresponding to two values of the power law index.
Author (TAB)

N70-27834# California Univ., Berkeley.
LINEAR THEORY OF COSSERAT SURFACE AND ELASTIC PLATES OF VARIABLE THICKNESS
A. E. Green, P. M. Naghdi, and M. L. Wenner 1970 69 p refs
(Contract N00014-69-A-0200-1008)
(AD-702092) Avail: CFSTI CSCL 20/11

Within the scope of the linear isothermal theory of an elastic Cosserat surface, constitutive equations are derived for an initially flat Cosserat surface in which the initial director (along the normal to the initial surface) is allowed to depend on the surface coordinates. These constitutive equations correspond to those for bending and stretching of a transversely isotropic three dimensional plate. Special attention is given to the relevance and applicability of the results to bending of (three dimensional) plates of variable thickness and comparison is made with a set of equations for elastic plates of variable thickness obtained, by an approximation procedure, from the three dimensional equations. Author (TAB)

N70-27835# California Univ., Berkeley.
ON SUPERPOSED MOTIONS IN ELASTIC-PLASTIC MEDIA
W. J. Shack 1970 36 p refs
(Contract N00014-69-A-0200-1008)
(AD-702091) Avail: CFSTI CSCL 20/11

Based on the general theory of elastic-plastic media developed by Green and Naghdi, a linearized theory of small deformation superposed on large deformations is obtained. The theory is used to discuss the twisting of a circular bar previously subjected to large extensions, and the propagation of infinitesimal plane waves through a plastically deformed material. Author (TAB)

N70-27905# Southampton Univ. (England). Inst. of Sound and Vibration Research.
FREE-WAVE PROPAGATION IN PERIODICALLY SUPPORTED, INFINITE BEAMS Summary Report, 1 Jun.–31 Dec. 1968
Denys J. Mead Jan. 1970 46 p refs
(Contract F61052-68-C-0027)
(AD-702111; AFML-TR-70-14) Avail: CFSTI CSCL 20/11

The notion of propagation constants for the free harmonic motion of infinite beams on identical, equi-spaced supports is first reviewed. Expressions are then derived for the flexural propagation constants for beams on rigid supports which exert elastic rotational restraint, and also for beams on flexible supports. A beam on rigid

supports has one propagation constant and a beam on flexible supports has two propagation constants for each frequency. Detailed consideration of the propagation constant leads to the conclusion that a freely-propagating harmonic flexural wave in such a beam must be regarded as a wave-group, having components of different wavelength, phase velocity and direction. The magnitudes of the components in some special cases are examined. The interaction between these groups and convected pressure fields is considered in qualitative terms. A mechanism is shown to exist whereby slow, subsonic convected pressure fields can generate flexural waves of supersonic velocity which can radiate sound. Author (TAB)

N70-27950*# Tennessee Technological Univ., Cookeville. Dept. of Engineering Science.

STRESS WAVES IN MULTIPLE LAMINATES

Ray Kinslow Mar. 1970 53 p refs

(Grant NGR-43-003-009)

(NASA-CR-89880; TTU-ES-70-1) Avail: CFSTI CSCL 20K

Fractures caused by stress waves resulting from high velocity impact are sometimes reduced and at other times are increased by the use of laminated materials. This is a theoretical study of the propagation and reflections of stress waves in laminated targets and an analysis of the effects of material properties, target geometry, and wave characteristics. The multiple reflections and transmitted components at the interfaces bounding each layer of material combine in phase so as to create stresses much greater than would have been produced in a homogeneous target. Author

N70-27962*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A STABILITY STUDY AND MORAL ANALYSIS OF A SPACE-STATION: CENTRIFUGE CONFIGURATION

Robert K. Sleeper and Harold C. Lester Washington May 1970 76 p refs

(NASA-TN-D-5801; L-6597) Avail: CFSTI CSCL 20K

The planar motion of a centrifuge - space-station configuration has been examined to determine the types of instabilities that can occur. Although the study is devoted primarily to undamped symmetric configurations, the effects on stability of linear viscous damping and mass asymmetry were also examined. A linear analysis which was effected by assuming constant speed rotation showed that with little or no damping, unstable motion can occur in rotational speed ranges or regions representing two types of instabilities: (2) The first region was bounded by upper and lower critical speeds and in this region the motion consisted of a self-excited pure divergence similar to that found for rotating shafts with elliptical cross sections. All configurations exhibited this type of instability which was attributed to the bidirectional dynamic properties of the centrifuge. (2) Special attention has been directed toward a second type of instability which may be overlooked in an analysis but which can occur at rotational speeds above the critical speed; it consists of a self-excited oscillatory divergence similar to that experienced by helicopter pylon-rotor configurations. Configurations with a heavy centrifuge hub or light gondolas were more likely to have this type of instability. For undamped models a superposition of the complex eigenvectors is employed to represent the various types of real motion in the rotating reference frame and a special stability technique applicable to even-power polynomials is used to determine stability boundaries. Author

N70-27967# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.

EXPERIMENTAL STUDY OF THE THERMAL BUCKLING OF CYLINDRICAL SHELLS

Menahem Baruch and Joseph Frum Sep. 1969 57 p refs

(Contract AF 61(052)-905)

(AD-702126; Scientific-9; TAE-92) Avail: CFSTI CSCL 20/11

Air-and spacecraft fuselage normally consist of cylindrical and conical thin-walled shells. High-speed flight causes heating (either through an external aerodynamic effect, or from an internal energy source such as the rocket engine), which is mostly non-uniform and may induce buckling. Earlier works on this subject have shown that the most critical case is that of circumferential variation of the temperature. The report describes a device permitting study of buckling due to combined thermal and mechanical load. A test series and its results are presented. The tests were carried out on fixed-ended cylindrical shells, linearly heated along the upper generator. The concept of thermal buckling is discussed in the light of test results. The present tests are compared with those of earlier studies and their conclusion that the ratio between the nominal thermal stress to the classical linear theoretical one is higher than the ratio between the experimental stress to the classical one in uniform axial compression is reconfirmed. Author (TAB)

N70-28019# Washington Univ., Seattle. Lab. of Statistical Research.

A NEW MATHEMATICAL MODEL FOR FATIGUE Technical Report

Z. W. Birnbaum, B. P. Lientz, and V. K. Murphy 15 Dec. 1969 18 p refs Prepared in cooperation with System Develop. Corp., Santa Monica, Calif.

(Contract Nonr-477(38))

(AD-702074; TR-58) Avail: CFSTI CSCL 20/12

The purpose of the paper is to present a new mathematical model for fatigue based on cumulative damage. The model is designed to take into account the dependence between damage increments occurring at different times. Author (TAB)

N70-28028*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

AN APPROACH TO RELIABILITY DETERMINATION OF A ROTATING COMPONENT SUBJECTED TO COMPLEX FATIGUE

Vincent R. Lalli and Dimitri B. Kececioglu [1970] 23 p refs

(NASA-TM-X-52790) Avail: CFSTI CSCL 20K

A methodology for determining the reliability of mechanical components is given. The necessary design data are pointed out. Complex fatigue research machines are described, which are generating the required fatigue strength data in terms of cycles to failure and endurance strength. The test loading is that of alternating bending combined with steady torque. The design data obtained are presented. The design by reliability methodology and data are applied to the design of an actual alternator rotor inner shaft, and the results are compared with those obtained by conventional design procedure. Author

N70-28099*# Shock Hydrodynamics, Inc., Sherman Oaks, Calif.

ANALYTICAL STUDY OF STRAIN RATE EFFECTS IN HYPERVELOCITY IMPACTS Final Report

M. Rosenblatt Jan. 1970 208 p refs

(Contract NAS8-20235)

(NASA-CR-61323) Avail: CFSTI CSCL 20K

For the very high deformation rates involved in hypervelocity impacts of small particles, rate effects can introduce important nonlinear size scaling effects in both cratering and ballistic limit phenomena. In this report, the consequences of rate phenomena are examined using results of two-dimensional STEEP code solutions which incorporate a general set of deformation rate sensitive constitutive relations. A phenomenological hydrodynamic-elastic-viscoplastic model valid in three dimensions is used. Detailed numerical solutions of 2024-T3 aluminum spheres impacting finite target of like material at 7.5 km/sec and at 15 km/sec are obtained. Non-linear size scaling effects are examined for the 7.5 km/sec impact case by comparing the solutions from two configurations which differ in size by a factor of 100 (D = .32 cm and D = 32 micron). Impact velocity effects are examined by comparing the 15 km/sec impact case and the 7.5 km/sec impact case (D = .32 cm). Spatial plots of the velocity and principal stress fields at selected problem times are presented. Author

N70-28102# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
METHOD FOR CALCULATING ROCKET ENGINE STRUCTURAL LOADS
Jerrell M. Thomas Washington May 1970 11 p refs
(NASA-TN-D-5825; M-363) Avail: CFSTI CSCL 20K

A method for calculating structural loads in a rocket engine-actuator-vehicle system is developed. The engine is attached to the vehicle by a universal-type gimbal joint and by two actuators. The engine is assumed to be a rigid body. Either the actuator loads or the engine angular acceleration is assumed to be known with a calculation of the other required. A set of algebraic equations is developed from which the unknown actuator loads or angular acceleration and the forces and moments at the gimbal point can be calculated. Author

N70-28166# Aerospace Corp., El Segundo, Calif. Lab. Operations.
ONE-DIMENSIONAL PULSE PROPAGATION IN AN OBLIQUELY LAMINATED HALF-SPACE, OCTOBER 1968 - APRIL 1969
Charles Sve and James S. Whittier 7 Dec. 1969 37 p refs
(Contract F04701-69-C-0066)
(AD-701738; TR-0066(5240-30)-5; SAMSO-TR-70-29) Avail: CFSTI CSCL 20/11

A solution is presented for the response of a periodically laminated half-space to a suddenly applied surface pressure. The lamination angle is arbitrary. Dispersion due to the structure of the composite is included by using a continuum theory that approximately models such behavior. The predominant long-time far-field solution is obtained using the head-of-the-pulse technique. This solution is contrasted with the first-order approximation obtained when the composite is represented by an equivalent homogeneous anisotropic elastic medium. Both theories yield a response to the step load consisting of two pulses, each traveling with a separate velocity. For the anisotropic elasticity theory, the pulses are simple steps, while for the dispersive theory, oscillations are superposed on the steps. The character of these oscillations is highly dependent on the lamination angle and other properties of the composite, particularly for the slower pulse. Representative numerical examples are presented. Author (TAB)

N70-28175# Technion--Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
THE BUCKLING OF STIFFENED AND UNSTIFFENED CONICAL AND CYLINDRICAL SHELLS Final Scientific Report, 1 Mar. 1966 - 15 Sep. 1969
Josef Singer Oct. 1969 28 p refs
(Contract AF 61(052)-905)
(AD-701447; TAE-102; AFOSR-70-0359TR) Avail: CFSTI CSCL 1/3

Theoretical and experimental research on the buckling of stiffened and unstiffened conical and cylindrical shells, carried out over a period of 3 years, is summarized. The topics of earlier work are outlined and the more recent topics are summarized. These include: discreteness effect in stringer-stiffened shells and the effect of elastic restraint on panels and sub-shells; the influence of inplane boundary conditions for ring-stiffened cylindrical shells; extensive tests on stringer-stiffened cylindrical shells under axial compression and ring stiffened conical shells under torsion; and also thermal buckling of cylindrical shells. Author (TAB)

N70-28213# Shock and Vibration Information Center (Defense), Washington, D.C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 2, NO. 1
Jan. 1970 21 p refs
(AD-699701) Avail: CFSTI CSCL 20/11

Abstracts of current technical literature are listed according to selected categories; feature articles contain state-of-the-art surveys, tutorial material and philosophical positions on technical subjects. Author (TAB)

N70-28248*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HEAD TO BASE TRANSFER FUNCTION CHARACTERISTICS OF A CYLINDRICAL TANK PARTLY FILLED WITH LIQUID
Carl F. Lorenzo, William G. Costakis, and Eva T. Jun Washington Jun. 1970 41 p refs
(NASA-TN-D-5845; E-5288) Avail: CFSTI CSCL 20K

An analysis is presented of the transfer function of head motion to base motion for a thin-walled cylindrical tank partially filled with a liquid. This transfer function is part of the overall structural description for the analysis of POGO type instabilities in rocket vehicles. The analysis utilized the double Laplace transform to achieve a closed form approximate solution. An experimental verification of the analysis was performed using a cylindrical plastic tank containing water. The results clearly demonstrated the importance of considering fluid resonance effects on head to base response. Indeed, for at least two fluid heights the fluid mode effects dominated the mechanical modes for this transfer function. Author

N70-28256# Central Electricity Generating Board, Berkeley (England). Berkeley Nuclear Labs.
SOLID WEDGE FINITE ELEMENT FOR STRESS ANALYSIS
T. K. Hellen Feb. 1969 15 p
(RD/B/N-1305) Avail: CFSTI

A wedge-shaped element containing fifteen corner and midside nodes suitable for use in three-dimensional structures is presented. The element has been incorporated in the CEGB general stressing system, called SAFE, and is designated EZ45. The element is expected to be used mainly in conjunction with the solid brick element with twenty corner and midside nodes, currently available in SAFE and designated EZ60. Author (NSA)

N70-28322# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
WAVE PROPAGATION IN THREE-LAYERED PLATES. APPLICATION TO ULTRASONIC DELAY LINES Research Report
Anthony E. Armenakas and Henry E. Keck Feb. 1970 39 p refs
(Contract Nonr-839(40))
(AD-702053; PIBAL-70-6) Avail: CFSTI CSCL 20/1

The propagation of trains of straight crested harmonic waves in infinitely long isotropic, traction free, three-layered plates is investigated on the basis of the three-dimensional linear theory of elasticity. It is established, that as in the case of waves traveling in homogeneous plates, the face shear motion and the longitudinal - flexural motion exist uncoupled. However, independent symmetric and antiasymmetric modes exist only in the case of three-layered symmetric plates; that is, plates having identical outer layers. The frequency equations have been evaluated numerically. The possibility is discussed of utilizing thin three-layered symmetric strings as delay media in guided wave ultrasonic delay lines having a linear delay versus frequency relation. Author (TAB)

N70-28340# Lockheed Missiles and Space Co., Palo Alto, Calif. Lockheed Research Lab.
PRESSURE HULL CANDIDATE 10 NI DUAL STRENGTHENED STEEL
L. Schapiro Jan. 1969 25 p
(AD-699864; LMSC-6-96-68-12) Avail: CFSTI CSCL 13/10

The program for acquisition of mechanical properties selected 3-1/2-in. plate as the thickness to be evaluated since this thickness, at the reported material strength, would be required for a 20,000-ft operating depth submersible. For proof of fabricability the program included manufacture and depth testing of a subscale spherical

pressure hull to illustrate material formability, weldability, and suitability of the weld quality for deep submergence service. As a step leading to Category 2 classification, the program also included explosive bulge testing of 2-in. plate weldments in conformance with NAVSHIPS 0900-005-5000. Author (TAB)

N70-28341# Ballistic Research Labs., Aberdeen Proving Ground, Md.

ANALYSIS OF TRANSVERSELY ISOTROPIC LAMINATED CYLINDERS UNDER AXISYMMETRIC MECHANICAL AND THERMAL LOADS

Jonas A. Zukas Nov. 1969 111 p refs
(AD-699805; BRL-1457) Avail: CFSTI CSCL 13/13

A theory for the analysis of stresses in laminated circular cylindrical shells subjected to arbitrary axisymmetric mechanical and thermal loadings has been developed. This theory, specifically for use with pyrolytic graphite type materials, differs from the classical thin shell theory in that it includes the effects of transverse shear deformation and transverse isotropy, as well as thermal expansion through the shell thickness. Solutions in several forms are developed for the governing equations. The form taken by the solution function is governed by geometric considerations. A range in which the various solution forms occur was determined numerically. As a sample problem the slow cooling of pyrolytic graphite deposited onto a commercial graphite mandrel was considered. Investigation of normal and shear stress behavior at the pyrolytic graphite - mandrel interface implies that a thin mandrel and a material weak in shear are desirable to minimize the possibilities of flaking and delamination of the pyrolytic graphite. Author (TAB)

N70-28560# California Univ., Livermore. Lawrence Radiation Lab.

A STATISTICAL MODEL FOR THE LIFE OF COMPOSITE MATERIALS UNDER ARBITRARY, TIME-VARYING LOADING

Larry M. Sweet and E. Y. Robinson 7 Oct. 1969 18 p refs
(UCRL-50764) Avail: CFSTI

A statistical model for ramp loading of composite materials is developed. The analysis shows that a significant decrease in time variability may be obtained by using ramp loading instead of conventional static fatigue testing. Some parameter discrimination is lost in exchange for the increased certainty in time. Ramp loading may discriminate between random and progressive mechanisms of failure. The ramp load analysis may be generalized to any loading function, and a preliminary estimate is made of the effects of variable loading. Author

N70-28646# Grumman Aircraft Engineering Corp., Bethpage, N.Y. Research Dept.

PLASTIC ANALYSIS OF STRUCTURES

Harry Armen, Jr., Allan B. Pifko, Howard S. Levine, and Gabriel Isakson Apr. 1970 122 p refs Submitted for publication
(RE-380J) Avail: CFSTI

This study represents a comprehensive development of finite-element methods to provide analytical means for determining the nonlinear response of aircraft structures. Consideration is given to material and geometric nonlinearity, acting separately or in combination. The methods are applicable to loading conditions that cause either membrane stresses or pure bending, or both in combination. The finite-element analysis methods for material nonlinearity can account for the Bauschinger effect for biaxial stress states by using the Prager-Ziegler kinematic hardening theory of plasticity. Application of the method is illustrated for several representative structures including notched bars and rectangular, circular, and annular plates, although these methods are fully capable of being applied to complex, builtup structures. Good correlation is obtained between results and existing experimental and/or analytical results. Author

N70-28745# Sandia Corp., Albuquerque, N.Mex.

AEROELASTIC BENDING ANALYSIS OF A TERRIER-TOMAHAWK 9 SOUNDING ROCKET VEHICLE

D. Q. Matejka Nov. 1969 40 p refs
(SC-DR-69-661) Avail: CFSTI

Substantial losses of vehicle static stability due to aeroelastic bending are calculated for a two-stage Terrier-Tomahawk 9 sounding rocket vehicle, using an aerolastic benaing analysis program adapted to the CDC 6600 computer. Flight performance of the first Terrier-Tomahawk 9 flown substantiates these large losses in static stability. The roll-resonance flight mode attained by the flexible flight vehicle is predicted. Author

N70-28762# Ghent Univ. (Belgium). Lab. voor Weerstand van Materialen.

WORK CARRIED OUT AT THE UNIVERSITY OF GHENT UP TO 30 JUNE 1969

22 Sep. 1969 11 p
(Contract EURATOM-081-67-1-TEEC(RD))
(EURAEC-2126; EUR-4019) Avail: CFSTI

Results are summarized for the weld tests performed on low and high thicknesses of steel plates. The welding of steel, in the thickness considered here, has given rise to very serious difficulties, due to weakness of the fusion line. The brittle condition responsible for this weakness can be obtained by a simulated weld cycle with a peak temperature of 1400 C. It can therefore be expected to exist at the fusion line in any type of weld. Electrolagwelds are particularly susceptible because they have a smooth fusion line running nearly straight across the thickness. Multilayer welds gave somewhat better results, but it was quite impossible to make a full size weld carry a nominal stress of more than one half of the yield point. In view of these difficulties, and considering the fact that the second steel is expected to be weldable by all usual procedures. Author

N70-28800*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

APPROXIMATE ANALYTICAL MODELS FOR LANDING ENERGY ABSORPTION, INCLUDING THE EFFECT OF PENETRATION BY THE PAYLOAD INTO ITS CRUSHABLE CASING

Robert W. Warner Washington Jun. 1970 93 p refs
(NASA-TN-D-5833; A-3335) Avail: CFSTI CSCL 20K

Two approximate analytical models are defined for a landing configuration in which a spherical payload can sometimes penetrate into its crushable casing. Results for both models are found to agree reasonably well with two previous experimental measurements. Design examples are presented for an impact velocity of 300 ft per sec. These are based on choices of zero or perfect payload bonding, and of either a balsa-like or honeycomb-like class of crushable material. The greatest difference between the models for the examples is a 29-percent discrepancy in the required maximum crushing stress. A particular pair of examples gives the unexpected result that penetration can provide a decrease in crushable material weight by a factor greater than 4 when the honeycomb-like class of material is required without penetration, but the more efficient balsa-like class is feasible with penetration. Author

N70-28853# Technische Hochschule Darmstadt (West Germany). Fakultaet fuer Bauingenieurwesen.

LIMITS OF VALIDITY FOR THE BEAM CALCULATIONS OF SHED SHELL CHAINS [EIN BEITRAG ZUR BESTIMMUNG VON GUELTIGKEITSGRENZEN DER BALKENMETHODE FUER DIE BERECHNUNG VON SHEDSCHALENKETTEN]

Georg Kinsky (Ph.D. Thesis) 1969 92 p refs In GERMAN
Sponsored by Deut. Forschungsgemeinschaft
Avail: CFSTI

The validity limits of three different beam methods for calculating shed shell chains were determined. The quality of the

approximation solutions were obtained from exact solutions of the blending theory of circular cylindrical shells. Investigations were carried out with several shed forms, based on existing buildings and the loadings were chosen to be realistic. Author (ESRO)

N70-28983# Atomics International, Canoga Park, Calif.
THERMAL GRADIENT EFFECTS ON STRESS-RUPTURE BEHAVIOR OF THIN-WALLED TUBING
J. H. Shively and M. W. Mahoney 2 Jan. 1970 33 p refs
(Contract AT(04-3)-701)
(AI-AEC-12896) Avail: CFSTI

The results of stress-rupture tests of internally heated and pressurized thin walled tubes of stainless steel are presented. The separate and combined effects were examined on creep behavior of stainless steel fuel rod cladding from thermal gradients through the wall, repeated thermal stress relaxation, cycle rate, mass transfer, and alloy type. Steady internal heating had little effect on creep behavior, even though evidence of mass transfer was found on the surface for times up to 600 hr. Cyclic heating reduced the life by a factor of 2, and produced large changes in the microstructures, strain profiles, and strain at failure. The reduced life, the effects of cycle rate, and the sensitivity to surface defects are explained semiquantitatively, in terms of an enhanced creep mechanism involving repeated stress relaxation of thermal- and creep-induced residual stresses. The results are discussed in terms of their implications for reactor fuel element design criteria.
Author (NSA)

N70-28995# Wissenschaftliche Gesellschaft fuer Luft- und Raumfahrt, Darmstadt (West Germany).
REPORT ON THE 15TH WGLR MEETING ON STRUCTURES AND AEROELASTICITY [BERICHT UEBER DIE 15. SITZUNG DES WGLR-FACHAUSSCHUSSES FESTIGKEIT UND AEROELASTIZITAET
Dec. 1968 53 p refs In GERMAN; ENGLISH summary Conf. held at Ottobrunn, West Ger., 2 Dec. 1966
(DLR-MITT-68-11) Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 10.92 DM

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1. THERMAL STRESSES IN FLAT PLATES H. Eschenauer (Tech. Hochschule, Darmstadt) p 7–23 refs (See N70-28996 14-32)

2. TEMPERATURE PROBLEMS IN LIFT ENGINE NACELLES FOR VTOL TRANSPORT, AIRCRAFT M. Flemming (Dornier-Werke) p 24–50 refs (See N70-28997 14-02)

N70-28996# Technische Hochschule Darmstadt (West Germany). Inst. fuer Mechanik.
THERMAL STRESSES IN FLAT PLATES [WAERMESPANNUNGEN IN EBENEN FLAECHENTRAGWERKEN]
H. Eschenauer *In* WGLR Rept. on the 15th WGLR Meeting on Struct. and Aeroelasticity Dec. 1968 p 7–23 refs In GERMAN (See N70-28995 14-32)
Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 10.92 DM

The most accurate determination of the thermal stresses in flat sheets is essential for the treatment of the coupled sheet-plate problem. Use of the reduction method of L. W. Kantorowitsch allows one to determine the stresses in rectangular sheets by means of a continuous calculation method.
Author (ESRO)

N70-29005*# Boeing Co., Huntsville, Ala.
ADVANCEMENTS IN STRUCTURAL DYNAMIC TECHNOLOGY RESULTING FROM SATURN 5 PROGRAMS, VOLUME 1
P. J. Grimes, L. D. Mc Tigue, G. F. Riley, and D. I. Tilden Washington NASA Jun. 1970 54 p refs
(Contract NAS1-8531)
(NASA-CR-1539; D5-17015) Avail: CFSTI CSCL 20K

Saturn 5 structural dynamic experience in replica modeling, math modeling, and dynamic testing was assessed. Major problems encountered in each of these areas and their solutions are discussed. The material is presented in two volumes. Volume 1 contains a summary of the material presented in Volume 2 and is oriented toward the program managers of future structural dynamic programs. Volume 2 contains the methods and procedures used in the Apollo Saturn 5 structural dynamics programs. The major problems encountered and their solutions are discussed. Volume 2 is oriented toward the technical leaders of future structural dynamics programs.
Author

N70-29016# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
CUMULATIVE FATIGUE DAMAGE STUDIES OF PINNED-LUG AND CLAMPED-LUG STRUCTURAL ELEMENTS IN ALUMINIUM ALLOY
W. T. Kirkby and P. R. Edwards London Aeron. Res. Council 1970 36 p refs Presented at the ICAF Symp., Stockholm, May 1969 Supersedes RAE-TR-69182; ARC-31669
(ARC-CP-1089; RAE-TR-69182; ARC-31669) Copyright. Avail: CFSTI; HMSO: 9s; BIS: $1.80

The growth of fatigue damage under constant amplitude loading and under variable amplitude loading is discussed, and the effects of static preload on subsequent fatigue performance are illustrated. Explanations of the observed patterns of behavior are put forward based on consideration of the residual stresses induced by plastic deformation. It is concluded that, it is advisable to use variable amplitude loading for component evaluation. The importance of using specimens having engineering configurations when evaluating new materials is also stressed.
Authro (ESRO)

N70-29017# National Physical Lab., Teddington (England). Div. of Inorganic and Metallic Structure.
INTERFACE EFFECTS AND THE WORK OF FRACTURE OF A FIBROUS COMPOSITE
A. Kelly Feb. 1970 40 p refs
(NPL-IMS-10) Copyright. Avail: CFSTI

The stresses near the tip of a crack which lies normal to a set of aligned fibres is discussed when the elastic properties of the composite are appropriate to those of a carbon-reinforced epoxy resin. Splitting parallel to the fibers is expected to occur before fiber fracture only if an interface parallel to the fiber of one fiftieth the strength of the composite parallel to the fiber is present. The two machanisms of energy dissipation which have been suggested to occur in a fiber composite of brittle fiber in a brittle matrix, viz. pull out and debonding are discussed and experiments to measure the latter are described. The work of debonding (less than 10,000 J/m) is usually less than the work of pull out. The theory of pull out is described and experiments to support it noted. The work of pull out increases linearly with fiber diameter, and is likely to be inconveniently small for fiber of diameter less than or = to 10 microns. The relative advantages and disadvantages of fiber of various diameters are discussed. Fiber of diameter less than or = to 25 microns lead to large works of pull out and are stable and easily handled. Thinner fibers (less than 10 microns diameter) give rise to constraint effects which are important in metallic matrices.
Author (ESRO)

N70-29076# California Univ., Livermore. Lawrence Radiation Lab.
DESIGN CONSIDERATIONS FOR RIB-STIFFENED FLANGES
Alexander Blake 23 Sep. 1969 53 p refs Sponsored by AEC
(UCRL-50756) Avail: CFSTI

A review of existing design formulas and theoretical

considerations applicable to standard flanges is presented and an approach to the analysis of stresses in rib-reinforced flanges subjected to axial loading is emphasized. The recommended formulas and procedures are aimed at reducing the calculation time and reducing the overall weight of downhole-hardware for underground nuclear testing. The parametric equations and working formulas presented in the report from the basis of the line-of-sight computer program presently under development. Author (NSA)

N70-29086# Bettis Atomic Power Lab., Pittsburgh, Pa.
HIGH-TEMPERATURE DEFORMATION AND BURST CHARACTERISTICS OF RECRYSTALLIZED ZIRCALOY-4 TUBING (LWBR DEVELOPMENT PROGRAM)
C. C. Busby and K. B. Marsh Jan. 1970 15 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-TM-900) Avail: CFSTI

Internal pressure burst tests of unirradiated, recrystallized Zircaloy-4 tubing were performed at isothermal temperatures ranging from 80 to approximately 1900 F to assess deformation characteristics before fracture. It was concluded that significant local deformation (bulging) could occur. It is also shown that a reasonable estimate of flow stress under combined stress loading can be obtained from uniaxial tensile data and a strain parameter (R) measured from the contractile strains observed in tensile tests. Author (NSA)

N70-29098# National Physical Lab., Teddington (England). Div. of Inorganic and Metallic Structure.
THE FRACTURE TOUGHNESS OF COMPOSITES REINFORCED WITH WEAKENED FIBRES
G. A. Cooper and D. G. Gladman Jan. 1970 25 p refs
(NPL-IMS-8) Copyright. Avail: CFSTI

Fiber fractures which occur near, but not at the plane of matrix failure in a composite, lead to fiber pullout during fracture. Energy absorbed in this process contributes directly to the work of fracture and hence to the toughness of the composite. Factors which determine the mean length of fiber pulled out during fracture are discussed for the case of composites reinforced with continuous fibers having variously spaced points of weakness. The presence of such weak points also affects the strength of the composite, but not all composites of the same strength have the same toughness. The greatest toughness for a given strength is always found in composites reinforced with discontinuous fibers. Author (ESRO)

N70-29106# Deutsche Forschungs- und Versuchsanstalt fuer Luftund Raumfahrt, Brunswick (West Germany). Inst. fuer Flugzeugbau.
THEORETICAL AND EXPERIMENTAL INVESTIGATION OF THE POSTBUCKLING BEHAVIOR OF THIN-WALLED CIRCULAR CYLINDERS WITH RIGIDLY CLAMPED EDGES AND SUBJECTED TO EXTERNAL PRESSURE [THEORETISCHE UND EXPERIMENTELLE UNTERSUCHUNG DES NACHBEULVERHALTENS DUENNWANDIGER KREISZYLINDER MIT EINGESPANNTEN RAENDERN UNTER AUSSENDRUCKBELASTUNG]
Hans-Reinhard Meyer-Piening (Ph.D. Thesis—Tech. Univ. Brunswick) Jan. 1970 92 p refs In GERMAN; ENGLISH summary
(DLR-FB-70-09) Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich 15.50 DM

Postbuckling states of equilibrium were calculated for thin-walled circular cylinders with rigidly clamped edges and subjected to external pressure, using Donnell's nonlinear shallow shell equations. Experiments on pressure loaded cylinders with the same edge conditions are described and load-shortening curves and deflection curves for a generatrix of the cylinder are given. The calculations produce good results up to relatively large deflections for cylinders with small values of the length parameter. Author (ESRO)

N70-29127# University Coll., Cork (Ireland). Dept. of Mathematical Physics.
EXAMPLES OF THE USE OF COMPUTER PROGRAM POLYZ BASED ON THE EDGE FUNCTIONS METHOD FOR LAPLACE, POISSON, ISOTROPIC PLATE AND ELASTOSTATIC PROBLEMS FOR POLYGONAL BOUNDARIES WITH OR WITHOUT SMOOTH CAVITIES Final Scientific Report
Patrick M. Quinlan Sep. 1969 96 p refs
(Grant AF-EOAR-68-0018)
(AD-701438; AFOSR-70-0383TR) Avail: CFSTI CSCL 20/11

A description, with ten illustrative examples, is given for computer program POLYZ evolved for isotropic plate, Laplace, Poisson and Elastostatic problems. The program consists of a main program with eighteen specialist subroutines, each of which discharges a specific task. Using this approach, the programming differences between problems in related topics, not covered in the present program, can generally be reduced to a difference in a few subroutines, and these can then be modified, or substituted, without too much difficulty, the greater part of the program remaining intact. Thus, a systems approach has been evolved. An effort has been made to make all examples self-explanatory. In all examples, the root mean square of the residuals on the boundary is given as the acceptance criterion for comparing the mathematical model with the physical model. Author (TAB)

N70-29175# Fraunhofer Institut, Freiburg (West Germany).
THE DISPLACEMENT OF THE CRACK MARGIN UNDER DYNAMIC LOADS [DIE VERSCHIEBUNG DER RISSUFER BEI DYNAMISCHER BELASTUNG]
E. Sommer and U. Soltesz 1970 16 p refs In GERMAN
Presented at the Natl. Symp. on Fracture Mech., Bethlehem, Pa., Aug. 1969
(Rept-1/70) Avail: CFSTI

The crack opening of an Araldite plate under a dynamic load was surveyed with simple optical interference equipment and a high speed camera. The aim of these investigations was to determine a dynamic stress-factor as a function of time, in an interval approximately 100 microseconds after the commencement of loading. An oscillation of the crack opening was observed. An oscillation of the K-factor, brought about by the impulse loading and an oscillation of the applied impulse itself, originating from the boundary conditions of the plate were shown to be important. Author (ESRO)

N70-29200# Shock and Vibration Information Center (Defense), Washington, D.C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 2, NO. 3
Mar. 1970 25 p refs
(AD-702515) Avail: CFSTI CSCL 20/11

Contents: Abstracts from the current literature (Analysis and design methods; Excitation, Phenomenology, Experimentation, Components, Systems); Book reviews; Short courses; Calendar of events. TAB

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N70-27889# Central Electricity Generating Board, Berkeley (England). Research and Development Dept.
EFFECT OF DIFFERENTIAL HEAT TRANSFER

COEFFICIENTS ON THERMAL STRESSES IN A NOZZLE SPHERE INTERSECTION

E. J. Chubb Jan. 1970 15 p

(RD/B/N-1497) Avail: AEC Depository Libraries

Spatial variations of surface heat transfer coefficient frequently occur in power plant components. These variations are thought to cause high thermal stresses. A particular aspect of the problem was investigated to establish the increases that may arise in one typical shape for reasonable variations in heat transfer coefficient. The component chosen was a relatively thick cylinder to sphere intersection. Author (NSA)

N70-27952*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

TURBINE COOLING: ITS LIMITATIONS AND ITS FUTURE

Jack B. Esgar [1970] 26 p refs

(NASA-TM-X-52801; E-5669) Avail: CFSTI CSCL 20M

The relative merits of convection, transpiration, and full coverage film cooling methods were analytically investigated for local turbine inlet temperatures from 2000 to 3500 F (1367 to 2200 K), gas pressures from 5 to 40 atmospheres (50.7 to 405.3 N sq cm), and cooling air temperatures from 600 to 1200 F (589 to 922 K). Effects of wall thickness and material temperature were also investigated. Transpiration or full coverage film cooling will probably be necessary to permit operation at local turbine inlet temperatures on the order of 3000 F (1922 K) and compressor pressure ratios of 20 or higher. Full coverage film cooling is often superior to transpiration cooling because oxidation problems with transpiration cooled materials reduce allowable metal operating temperatures. Author

N70-27980*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ANOMALOUS BEHAVIOR OF LIQUID NITROGEN DROPS IN FILM BOILING

Kenneth J. Baumeister, Edward G. Keshock (Old Dominion Univ., Va.) and Donald A. Pucci (Cleveland State Univ.) [1970] 18 p refs Presented at Cryog. Eng. Conf., Boulder, Colo., 17–19 Jun. 1970

(NASA-TM-X-52800) Avail: CFSTI CSCL 20M

The vaporization time of large drops of ordinary fluids such as water, ethanol, or benzene have been correlated by conventional laminar film boiling theory. However, liquid nitrogen data has been found to have a 30 percent shorter vaporization time than predicted by theory. Experimental and theoretical attempts are made to resolve this discrepancy. An asymptotic expression for the vaporization time of large drops in film boiling was derived. This expression seems to correlate the nitrogen data. Also, a new expression for the modified latent heat of vaporization is derived. This expression is useful for large temperature gradients occurring within the vapor film supporting the drop or for fluids having small latent heats such as would occur for cryogens or ordinary fluids near the thermodynamic critical point. Author

N70-28004# Oak Ridge National Lab., Tenn.

OFFICE OF SALINE WATER TUBE IDENTIFIER: A PHYSICAL DESCRIPTION OF TUBES TESTED IN THE OSW PROGRAM ON IMPROVED HEAT-TRANSFER SYSTEMS FOR EVAPORATORS: ADVANCED LTV HEAT-TRANSFER SURFACES

H. W. Hoffman and L. G. Alexander Oct. 1969 20 p

(Contract W-7405-eng-26)

(PB-187238; ORNL-TM-2713) Avail: CFSTI CSCL 13B

A study was made of the thermal performance of evaporator-condenser tubes modified in various ways to augment condensation, evaporation, and/or boiling coefficients. A tabulation is given which provides a convenient reference as to the physical characteristics of the many tubes examined. USGRDR

N70-28052# California Univ., Livermore. Lawrence Radiation Lab.

MANUFACTURING ACCURACY THROUGH THE CONTROL OF THERMAL EFFECTS

Eldon R. Mc Clure 30 Apr. 1969 320 p refs

(UCRL-50636) Avail: CFSTI

Power supplied to a machine tool is converted into heat resulting in thermal distortions in finished workpieces. Imperfect control of ambient temperatures causes gaging errors. Methods of detection that are related to established concepts of engineering metrology are described. The drift of a gage can be characterized by its response to a step input in ambient temperature, and the distortion of a machine-tool structure in response to multiple internal heat. Two methods of reducing or eliminating thermal effects are investigated. One is automatic error compensation, a form of which is derived from the error predictor that results from the identification of the parameters in the lumped-parameter model. A simple, inexpensive error computed based on thermal analogy is demonstrated. The other method is the regulation of structural temperatures by means of fluid coolants. Errors resulting from the expansion of the workpiece and the cutting tool during the turning of cylindrical parts is investigated both analytically and experimentally. Author (NSA)

N70-28056*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

LIQUID OR SOLID ON LIQUID IN LEIDENFROST FILM BOILING

R. C. Hendricks and K. J. Baumeister Jun. 1970 36 p refs Presented at the Cryogenic Eng. Conf., Boulder, Colo., 17-19 Jun. 1970

(NASA-TM-X-52783) Avail: CFSTI CSCL 20M

A hydrodynamic model is postulated for a small, liquid or solid sphere film boiling on a saturated cryogenic liquid surface, such as may occur in propellant spillage accidents and in the preparation and preservation of some biological species (e.g., blood and enzymes). The momentum and energy equations are solved analytically to predict the velocity and temperature fields in the vapor film beneath the sphere. This leads to a heat-transfer coefficient expression, and when combined with a thermal balance predicts the time a hot sphere will remain levitated in Leidenfrost film boiling when placed on a cryogenic liquid. The agreement between experimental and predicted times is fair. Author

N70-28070*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Engineering Mechanics Div.

A PARAMETRIC ANALYSIS OF VENUS ENTRY HEAT-SHIELD REQUIREMENTS

W. Jaworski and R. G. Nagler 15 Apr. 1970 46 p refs

(Contract NAS7-100)

(NASA-CR-109964; JPL-TR-32-1468) Avail: CFSTI CSCL 20M

A parametric study to determine heat-shield weight and thickness requirements for possible range of Venus entries is presented. The 1968 Venus (V-3) model atmosphere was used in calculating convective and radiative entry heating rates. The lower velocity is representative of an out-of-orbit entry, and the higher velocity of an entry from a Venus-Mercury flyby. A number of available heat-shield charring materials were considered. It was found that, subject to char shear-strength limitation, lower density materials are satisfactory for low energy entries; for higher energy entries, denser materials with chars of higher shear strength must be used. Author

N70-28100*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EXPERIMENTAL CONFIRMATION OF CYCLIC THERMAL JOINT CONDUCTANCE

Daniel J. Mc Kinzie, Jr. [1970] 17 p refs Proposed for presentation at the 5th Thermophys. Conf., Los Angeles, 29 Jun. - 1

Jul. 1970; sponsored by AIAA
(NASA-TM-X-52805) Avail: CFSTI CSCL 20M

Experimental heat transfer data obtained from a tungsten-tungsten and an Armco Iron-Armco Iron specimen have confirmed the Bowden and Tabor model of elasto-plastic events which occur during the cyclic engagement of surfaces in the lightly loaded range. The specimens consisted of cylinders having a diameter of 2.54 cm. Their surfaces of contact were outgassed before the tests were conducted and each was run in a high vacuum environment. The contacting surfaces of both specimens were extensively surveyed in roughness height, waviness, and profile before the tests were performed. The use of a surface analyzer and microhardness tester is required. Clausing and Chao's macroscopic elastic theory of deformation was applied to the Armco Iron specimen and the agreement was found to be good. Author

N70-28104*# Dynamic Science, Irvine, Calif.
FUNDAMENTAL IGNITION STUDY FOR MATERIAL FIRE SAFETY IMPROVEMENT Quarterly Report, 1 Jan. -31 Mar. 1970
L. B. Zung and K. L. Paciorek 31 Mar. 1970 19 p refs
(Contract NASw-1921)
(NASA-CR-73441; SN-169-12; QR-3) Avail: CFSTI CSCL 20M

A number of runs were conducted using Delrin resin discs in a stagnation burner under air and oxygen atmospheres. Based on the results obtained it would appear that ignition is mainly dependent on the temperature of the polymer heating block and not on the gas temperature. It would also appear, from the limited number of tests, that in air this temperature was in the vicinity of 500 C, whereas in oxygen it is close to 380 C. The ignition delay at least, in the oxygen series can be closely correlated with the polymer heating block temperature. Only traces of formaldehyde and formic acid were detected in the samples collected close to ignition and during combustion in the oxygen runs. The data collected tend to indicate that prior to ignition, in the runs where early ignition was observed, the decomposition of the formaldehyde resin to CO and H2 is the ignition determining step. Author

N70-28154# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HEAT EXCHANGE CRISIS DURING BOILING OF A FLOW OF WATER IN A CHANNEL
G. N. Kruzhilin et al 18 Nov. 1969 22 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Energ. i Transp. (Moscow), no. 3, 1969 p 86-94
(AD-702290; FTD-MT-24-309-69) Avail: CFSTI CSCL 18/9

A qualitative analysis of the influence of moisture content, speed of vapor, mass velocity of flow on critical thermal power of a channel and specific ultimate critical loads is given, along with practical methods of determination of conditions of a crisis under annular flow conditions of a steamwater mixture: empirical methods intended for calculation of specific ultimate loads and critical thermal power of a channel. Conditions of appearance of a crisis in a channel are analyzed during a cosinusoidal heat emission which is characteristic for channels of a nuclear reactor. Total critical thermal power of a channel and flow parameters in the crisis section are calculated. The influence of regime and shape factors on critical thermal power of a channel is examined. Author (TAB)

N70-28260# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Neutronenphysik und Reaktortechnik.
MEASUREMENT OF THE HEAT CURRENT FUNCTION OF SEVERAL CARBON AND GRAPHITE FELTS
F. E. Reiss Oct. 1969 20 p refs In GERMAN
(KFK-1062) Avail: AEC Depository Libraries

The heat current functions of commercially available carbon- and graphite-felts in vacuo were measured. The method and apparatus employed are described. Resulting data of eight different felts are shown graphically. Numerical equations to evaluate heat current function and thermal conductivity of the felts are given. Author (NSA)

N70-28313# Los Alamos Scientific Lab., N. Mex.
FABRICATION OF POROUS COPPER HEAT EXCHANGER MEDIA FOR He(3)-He(4) DILUTION REFRIGERATORS
Haskell Sheinberg and William A. Steyert 15 Jan. 1970 3 p refs
(Contract W-7405-eng-36)
(LA-4259) Avail: CFSTI

Temperatures near absolute zero were obtained with a He-3 -He-4 refrigerator. Preparation of porous copper heat exchanger media used in the refrigerator is described in detail. The fabricated porous copper is characterized by metallographic examination and by impedance to nitrogen flow. The refrigerator employing the porous copper has reached a temperature of 0.013 K. Author (NSA)

N70-28327# Texas Univ., Austin. Applied Mechanics Research Lab.
ON HYPERSONIC SHAPES OF MINIMUM HEAT TRANSFER Technical Report
David G. Hull Aug. 1969 9 p refs
(Grant AF-AFOSR-1744-69)
(AD-702107; VSAF-001) Avail: CFSTI CSCL 20/4

It is shown that if the slender-body approximation is introduced into the functional, one can determine a shape which minimizes the convective heating rate for a given length and diameter. Author (TAB)

N70-28581# Los Alamos Scientific Lab., N.Mex.
MERCURY AS A HEAT PIPE FLUID
J. E. Deverall Oct. 1969 11 p refs
(Contract W-7405-eng-36)
(LA-4300) Avail: CFSTI

Two heat pipes were tested to determine the feasibility of using mercury as a heat pipe fluid: one pipe was life-tested for 10,000 h at 330 C to study the wetting characteristics of mercury in a stainless steel structure; and the other was built and operated to determine the heat transfer capability of a mercury system and to compare its operational limitations with theoretical values. The life test indicates that good wetting of wick structures can be attained and that long-term operation is possible without excessive corrosion. The heat transfer test demonstrated that mercury behaves as a normal heat pipe fluid with regard to its operational limitations and startup dynamics. Construction of mercury heat pipes for high heat transfer rates appears to be feasible for operation between 200 and 400 C. Author

N70-28600*# Boeing Co., Seattle, Wash. Aerospace Systems Div.
LIMITATIONS IN THERMAL SIMILITUDE Final Report
Robert K. Mac Gregor Dec. 1969 252 p refs
(Contract NAS8-21422)
(NASA-CR-102871; D2-121352-1) Avail: CFSTI CSCL 20M

A research program examined and defined some of the limitations in thermal scale modeling. It is concluded that: (1) multilayer insulation is the major problem area in the scale modeling of unmanned spacecraft; (2) numerical analysis can be used to improve thermal scale model experimental results by correcting for known compromises of the scaling criteria; (3) the probable error in the experimental scale modeling study fall within the range predicted by the statistical analysis of errors due to uncertainties in thermophysical properties, geometric dimensions, and the test environment. Author

N70-28641# Air Force Systems Command, Wright-Patterson AFB Foreign Technology Div.
PENETRATION DEPTH AND BOUNDARIES OF A

CIRCULAR TURBULENT GAS DIFFUSION FLAME IN THE TRANSVERSE FLOW

A. Kink et al 4 Oct. 1969 11 p refs Transl. into ENGLISH from Akad. Nauk Est. SSR, Izv. Fiz., Mat. (ESTONIAN), No. 2, 1967 p 196–200
(AD-700789; FTD-HT-23-516-68) Avail: CFSTI CSCL 21/2

The study of flame propagation and its boundary limits are of interest in the design of furnace equipment and other heating apparatus. The investigation deals with only a portion of the complex problem, namely, the study of the combustion process of gas escaping into surrounding space and into a transverse flow of air. Author (TAB)

N70-28687*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

SOLUTIONS OF TWO HEAT-TRANSFER PROBLEMS WITH APPLICATION TO HYPERSONIC CRUISE AIRCRAFT

Mark D. Ardema Washington Jun. 1970 22 p refs
(NASA-TM-X-2025; A-3556) Avail: CFSTI CSCL 20M

Solutions are obtained for two initial boundary value problems of one dimensional heat conduction. The problems concern insulation systems for liquid hydrogen fueled hypersonic aircraft. The solutions are obtained by standard analytical techniques and are used to develop procedures for estimating the weight of insulation systems for such aircraft. Numerical results are presented and compared with results of a finite difference analysis, and agreement is found to be excellent. The solutions are compared with steady-state approximations, and it is concluded that these approximations provide convenient weight estimating formulas. Author

N70-28708# National Bureau of Standards, Boulder, Colo. Cryogenics Div.

THERMAL CONDUCTANCE AT THE INTERFACE OF A SOLID AND HELIUM 2 (KAPITZA CONDUCTANCE)

N. S. Snyder Dec. 1969 98 p refs
(AEC Order AT(49-2)-1165)
(NBS-TN-385) Avail: SOD $1.00

A review is presented of the experimental and theoretical work on Kapitza conductance, including a compilation of the available data on conductance to helium II. A short derivation of the phonon radiation limit indicates the reason for the approximate temperature dependence and the small size of the Kapitza conductance for most solids. Considerable qualitative and quantitative correspondence of the data with this limit is found. From the limited evidence available, the role of surface conditions, and of bulk parameters such as the Debye temperature in determining the conductance are considered empirically. Theoretical knowledge of the Kapitza conductance is seen to give an inadequate explanation of the data. In addition, the phenomena which occur when the heat flux is high enough that properties of the bulk liquid are also involved in the measured conductance are described briefly. Author

N70-28763# Northwestern Univ., Evanston, Ill. Dept. of Physics.

ON FLUIDS OF PARTICLES WITH SHORT RANGE REPULSION AND WEAK LONG RANGE ATTRACTIVE INTERACTION. PART 2: THE TWO PARTICLE DISTRIBUTION FUNCTION

John B. Jalickee, Arnold J. F. Siegert, and David J. Vezzetti (Illinois Univ., Chicago) 5 Dec. 1969 30 p refs
(Contract N00014-67-A-0356-0002; Grants NSF GP-7328; NSF GP-8734)
(AD-701131; TR-2-5) Avail: CFSTI CSCL 20/13

Part I of the paper (AD-672 845) presented an expansion of the pressure and density in grand canonical form and corrections to the Maxwell rule for a system of particles with short range repulsion and weak long range attraction. These expansions can be ordered in powers of gamma, the inverse range of the attractive potential. It was assumed that the thermodynamic functions and the molecular distribution functions of the reference system, i.e., the system with only the repulsive interaction, are given. In the present paper the gamma-expansion of the pair distribution function is calculated, under the same assumption. This pair distribution function vanishes, as it should, in the hard core region, if the repulsive potential has a hard core. This removes an objection against the gamma-expansion, which was stated by a previous author and would have cast doubt on the gamma-expansion in the entire range of fugacities and temperatures. Author (TAB)

N70-28806# Oak Ridge National Lab., Tenn.

COMPUTER CALCULATION OF TWO-DIMENSIONAL, STEADY-STATE HEAT TRANSFER IN CONCENTRIC CYLINDERS WITH INTERNAL HEAT GENERATION

G. A. Cristy (M.S. Thesis—Tennessee Univ., Knoxville) Feb. 1970 147 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2802) Avail: CFSTI

A computer program was developed for calculating steady state temperature distributions in concentric axisymmetric cylinders having internal heat generation. The program, takes into account heat transfer by conduction, convection and radiation. Input consists of the dimensions of the cylinders and the thermal characteristics of the materials. The program divides the cylinders into nodes, arranges the connectors and calculates the temperature distribution in two dimensions. After calculating the temperature distribution in an array of nodes, the program subdivides the nodes and calculates the temperature distribution in the more detailed nodal system. The program provides an ability to calculate heat transfer by conduction and radiation across gas filled gaps within the cylinder, and to calculate the variation of the width of the gap due to thermal expansion. A program listing and instructions for assembly of input data are included. Author (NSA)

N70-28836# Atomics International, Canoga Park, Calif.

ANALYSIS OF THE STATISTICAL DISTRIBUTION OF INCIPIENT BOILING

J. A. Landoni 31 Dec. 1969 31 p refs
(Contract AT(04-3)-701)
(AD-AEC-12906) Avail: CFSTI

A recent study of boiling initiation in sodium flowing in a heated channel showed that a statistical distribution of bulk superheat temperatures is obtained for otherwise fixed experimental conditions. The distribution of incipient boiling cases versus wall superheat appears to be a Poisson type distribution with a definite asymmetry. The departure from a Gaussian distribution is noticeable, however, and it can be speculated that the maximum superheat values are not firm values, but might be exceeded when more data are available. This possibility leads to a theoretical investigation of the observed statistical distribution. The Kolmogorov equation was combined with the equations for all-liquid thermal balance and used to analyze a typical distribution of incipient boiling cases. It is shown that the distribution is non-Poissonian and that for the situation prevailing in the temperatures above the observed maximum wall superheat is remarkably low. Author (NSA)

N70-28874# Houston Univ., Texas. Dept. of Mechanical Engineering.

THE VAPOR EXPLOSION: HEAT TRANSFER AND FRAGMENTATION

L. C. Witte and J. E. Cox Jan. 1970 17 p refs
(Contract AT(40-1)-3936)
(ORO-3936-2) Avail: CFSTI

Initial progress in an investigation of the interaction of hot, molten materials and liquids is reported. In studying the contributions of heat transfer and fragmentation to the overall phenomenon of explosive vapor formation the following four areas of interest were investigated: interaction of molten metal and liquids; transient heat transfer from small particles; stability of a

molten jet; and the effect of pressure on vapor formation. Experimental and theoretical work in these four fields is reported. The results indicate that fragmentation is strongly dependent on the cooling characteristics of the quenching liquid. A technique for making vapor pressure calculations is described. A computer program for performing heat transfer calculations is being formulated. NSA

N70-29001# Aerotherm Corp., Mountain View, Calif.
EVALUATION OF A TRANSFER COEFFICIENT APPROACH FOR UNEQUAL DIFFUSION COEFFICIENTS
Eugene P. Bartlett and Ronald D. Grose 30 Jun. 1969 130 p refs Prepared for Sandia Corp.
(SC-CR-69-3270) Avail: CFSTI

Solutions generated with a multicomponent laminar chemically-reacting boundary-layer procedure, including results for steady-state ablation of graphite and a typical reinforced plastic, are used to evaluate an unequal-diffusion transfer-coefficient formulation presented previously. The approximate and exact procedures are shown to agree quite well when the transfer-coefficients used in the former approach are obtained directly from boundary-layer solution data. Also, a tentative approach for correlating these heat- and mass-transfer coefficients is recommended which is believed to offer a substantial improvement over present practices for the prediction of graphite and reinforced-plastic ablation response during actual or simulated ballistic reentry conditions. Author

N70-29015# Hamburg Univ. (West Germany). Inst. fuer Physikalische Chemie.
SIMPLIFIED THERMODYNAMIC TREATMENT OF EQUILIBRIUM AND NONEQUILIBRIUM CONDITIONS IN PHYSICAL CHEMISTRY [VEREINFACHTE THERMODYNAMISCHE BEHANDLUNG VON GLEICHGEWICHTS- UND NICHTGLEICHGEWICHTSZUSTAENDEN IN DER PHYSIKALISCHEN CHEMIE]
Georg Job (Ph.D. Thesis) 1968 45 p refs In GERMAN *Its* Math. Nat. No. 410
Avail: CFSTI

By a suitable choice of partly known, partly new, often trivial rules for the identical transformation of differential expressions, the number of thermodynamic calculations can be reduced, and the result of many problems can be condensed into one line. All the reciprocity relations of classical thermodynamics and of the thermodynamics of irreversible processes can be obtained in one single calculation step. Author (ESRO)

N70-29021# National Physical Lab., Teddington (England). Div. of Numerical and Applied Mathematics.
SOME SECOND-ORDER EFFECTS IN THERMOELASTICITY THEORY
A. F. Johnson Mar. 1970 73 p refs Sponsored in part by Sci. Res. Council
(NPL-DNAM-84) Copyright. Avail: CFSTI

A systematic second-order theory of thermoelasticity is derived and used as a basis for the study of second-order effects in one-dimensional longitudinal wave motion in a heat-conducting elastic solid. A traction boundary value problem is formulated for a semi-infinite isotropic body and reduced to a sequence of linear initial-boundary value problems. The asymptotic solution to the first problem, a problem in coupled linear thermoelasticity theory, is obtained by application of a singular perturbation method. An investigation of the second problem reveals that the linearized solution is not uniformly valid for all times, and a technique is described by which governing equations for the large time solution are obtained. It is found that the leading term of this far field is governed by a nonlinear diffusion equation. Numerical results are presented and a discussion is given of the importance of second-order effects in mechanical pulse propagation. Author (ESRO)

N70-29070# Argonne National Lab., Ill.
A STUDY OF THE INCIPIENT BOILING OF SODIUM
Robert E. Holtz and Ralph M. Singer Oct. 1969 43 p refs Sponsored by AEC
(ANL-7608) Avail: CFSTI

In experimental studies that measure the amount of liquid superheat required to nucleate the liquid alkali metals, conflicting and generally insufficiently explained data have been presented. The incipient-boiling superheat has been shown or postulated to be affected by the pressure-temperature history, liquid pressure, heat flux, liquid purity, dissolved-gas content, liquid velocity, surface conditions, nuclear radiation, heating method, length of time of operation, and perhaps others. Several of these effects are shown experimentally and theoretically to be interrelated and the relative importance of each is discussed. A theoretical analysis has revealed that the heat-flux and heating-method effects upon the wall superheat are explainable by inert-gas transport between the liquid metal and the surface cavities. It has also been demonstrated that the bulk liquid superheat is affected by the heat flux and liquid velocity as well as by the method used to approach incipient boiling. Author (NSA)

N70-29124# Grumman Aircraft Engineering Corp., Bethpage, N.Y. Research Dept.
EMITTANCE PROPERTY RESEARCH ON THERMAL SHIELDS FOR SPACE SHUTTLE
J. Reichman May 1970 15 p refs
(RM-478) Avail: CFSTI

The high temperature emittance of the ceramic materials in consideration for use as a re-entry shield for the space shuttle is about 0.4. It is most desirable to increase this emittance by a factor of two. To achieve this objective, more knowledge is required concerning the scattering and absorption of radiation in a ceramic material. A research program to provide this information is described. A method of increasing the emittance by adding transition metal and/or rare earth ion impurities is discussed. Background information is provided to give a qualitative and quantitative understanding of the relationship of emittance to the physical and microscopic properties of the ceramic material. Author

N70-29192# North Carolina State Univ., Raleigh. Dept. of Nuclear Engineering.
CONSIDERATIONS REGARDING THE ACOUSTICAL DETECTION OF BOILING IN THE PRESENCE OF CAVITATION
R. F. Saxe Jun. 1969 29 p refs
(Contract AT(40-1)-3911)
(TID-25328) Avail: CFSTI

Acoustic methods for detecting incipient boiling in reactor cores, both water- and liquid metal-cooled, were investigated for the purpose of devising a method by which the onset of nucleate boiling could be determined at a speed compatible with possible control action. Previous experiments on boiling noise and noise from cavitation are reviewed. The mechanics of bubble collapse, acoustic emission, and of light emission are discussed. The difficulties of distinguishing boiling bubble emissions and cavitation bubble acoustic emissions are enumerated. It is concluded that in both water-cooled and liquid metal-cooled systems with considerable subcooling and in the absence of cavitation noise, boiling may readily be monitored acoustically. When only moderate amounts of cavitation noise are present, acoustic pulse techniques are preferable to continuous wave techniques for acoustic monitoring. With large amounts of cavitation noise present, the use of a relative time-of-arrival method for distinguishing boiling noise from cavitation noise seems feasible. NSA

34 GENERAL

Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents.

N70-27887# Office of Research Analyses, Holloman AFB, N.Mex.
ON THE DIFFUSION OF INNOVATIONS RESEARCH TRADITION Final Report
Gustavo M. Quesada Nov. 1969 48 p refs
(AD-701001; ORA-69-0016) Avail: CFSTI CSCL 5/10

The report analyzes the decision-making process of the diffusion of technological innovations and attempts to make the analysis more meaningful for the Air Force by emphasizing the role of authoritarian, contingent, and collective type of decisions. The author describes the characteristics of innovations, different types of adopter categories (while emphasizing the role of the earlier adopters), and the diffusion process and adoption stages. Author (TAB)

N70-28076*# Denver Research Inst., Colo. Industrial Economics Div.
PROJECT FOR THE ANALYSIS OF TECHNOLOGY TRANSFER Quarterly Report, 1 Oct. - 31 Dec. 1969
Dean C. Coddington, James E. Freeman, Eileen R. Staskin, and Nancy G. Gundersen 30 Jan. 1970 166 p
(Contract NSR-06-004-063)
(NASA-CR-109959; QR-8) Avail: CFSTI CSCL 05B

The results of research on technology utilization are discussed. Subjects presented are: (1) Tech Brief-Technical Support Package Program analysis, (2) technical support package requests, (3) technology transfer, (4) information retrieval, and (5) data transmission. An analysis of the types of data requested and the frequency of requests is included. Author

N70-28077# Joint Publications Research Service, Washington, D.C.
TRANSLATIONS ON EASTERN EUROPE SCIENTIFIC AFFAIRS, NO. 102
4 Mar. 1970 36 p refs Transl. into ENGLISH from Eastern European publications
(JPRS-49981) Avail: CFSTI

CONTENTS:

1. RESEARCH IN MAGNETOHYDRODYNAMICS SUMMARIZED A. Nicolaide p 9 - 11 (See N70-28078 14-25)
2. SCIENTIFIC WORK AT TIMSOARA REVIEWED T. Sava p 12 - 16 (See N70-28079 14-34)

N70-28079# Joint Publications Research Service, Washington, D.C.
SCIENTIFIC WORK AT TIMISOARA REVIEWED
T. Sava *In* Transl. on Eastern Europe Sci. Affairs, No. 102 4 Mar. 1970 p 12 - 16 Transl. into ENGLISH from Scintoia (Bucharest), 30 Jan. 1970 p 1 and p 5 (See N70-28077 14-34)
Avail: CFSTI

Industrial problems in plasma welding are discussed. Hydraulic coupling and use of plastic brake shoes are mentioned. S.S.

N70-28108# RAND Corp., Santa Monica, Calif.
UNCONSTRAINED OPTIMIZATION IN THE INTEGERS
B. L. Miller Jan. 1970 43 p refs
(Contract F44620-67-C-0045)
(AD-702429; RM-6165-PR) Avail: CFSTI CSCL 15/5

The paper presents a reconsideration of the NORS aircraft problem (not operationally ready--supply) and its dual subproblem for the case of a discretely convex function. The memorandum describes an algorithm that will apply to the Air Force procurement problem for a reparable single-echelon inventory system. The study identifies functions for which a local optimum is a global optimum, and develops a general solution strategy for finding the optimum in the promising areas. Results suggest that a NORS criterion might be more attractive than a backorder criterion in designing future increments of the AFLCs Advanced Logistics System. METRIC would still be necessary, since it alone is a two-echelon model that can furnish the proper depot stock levels. After the depot stock levels are fixed, a post-METRIC NORS calculation could take place. TAB

N70-28116*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
COMMUNICATION FOR THE 70's
12 Dec. 1969 188 p refs
(NASA-TM-X-53965) Avail: CFSTI CSCL 05B

The vital role of effective communication within technical fields is discussed. Scientific knowledge was disseminated through various media: reports, illustrations, presentations, and simple work of mouth. Author

N70-28146# Defence Standards Labs., Maribyrnong (Australia).
DEFENCE STANDARDS LABORATORIES Annual Report, 1968 - 1969
1969 71 p refs
Avail: CFSTI CSCL 05B

The following topics are discussed: explosives and ammunition research, corrosion, surface coatings, organic materials research, chemical physics, organic chemistry, crystallography, photoconductors, atmospheric contamination, pharmacology and biochemistry, lasers and optics, metrology, fracture research, deformation research, machining research, welding research, solidification, temperature research, and instrumentation and techniques. R.B.

N70-28168# Radio and Space Research Station, Slough (England).
FIFTH TWO-YEARLY CATALOGUE OF REPORTS AND REPRINTS RECEIVED BETWEEN JANUARY 1968 AND DECEMBER 1969
Dec. 1969 37 p refs
Avail: CFSTI

A bibliography of reports, reprints, and journals is presented on topics in space research, satellites and probes, orbits and flight paths, tracking, data recovery, instrumentation, applications of satellites, interplanetary probes, gravitational and magnetic fields, radiation, atmospheres of earth and sun, radiowave propagation, meteors and meteorites, biological and medical problems, astronomy, plasma physics, and mathematics. R.B.

N70-28257# RAND Corp., Santa Monica, Calif.
THE POSSIBILITIES OF DEVELOPING AN EFFECTIVE NATIONAL TRANSPORT SYSTEM IN THE 1970's
Laurel Roennau Mar. 1970 22 p
(AD-702670; P-4277) Avail: CFSTI CSCL 13/2

The report deals with the basic tools essential for the transportation needs of the future. These are: data collection, traffic forecasting regulatory aspect of transport growth, modal split considerations and traffic flow limitations. Some of the major problems where use can be made of these tools are considered. TAB

N70-28288*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RESPONDING TO REQUESTS AT THE NATIONAL SPACE SCIENCE DATA CENTER
James A. Fava, C. Kenneth Michlovitz, and Nick Karlow May 1970 13 p refs Submitted for publication

(NASA-TM-X-63909; X-601-70-162) Avail: CFSTI CSCL 05B

An operational analysis of the National Space Science Data Center (NSSDC) is presented. The data services provided by this facility are described along with the processes involved in the retrieval and dissemination of information. In order to handle the worldwide requests for space science data, NSSDC has developed and put into operation a Request Accounting, Status and History (RASH) file to provide up-to-date information on the number of requests, their status, estimated and actual costs, and processing time. D.L.G.

N70-28291# Naval Research Lab., Washington, D.C.
REPORT OF NRL PROGRESS, MARCH 1970
William M. Leak, ed. Mar. 1970 47 p refs
(NAVSO-P-3012) Avail: CFSTI

CONTENTS:

1. RESEARCH IN NONLINEAR OPTICS H. Rabin p 1–23 refs (See N70-28292 14-16)
2. CHEMISTRY: PROBLEM NOTES p 24–26 (See N70-28293 14-06)
3. COMMUNICATIONS SCIENCES: PROBLEM NOTES p 26-27 (See N70-28294 14-21)
4. ELECTRONICS: PROBLEM NOTES p 27–29 refs (See N70-28295 14-09)
5. METALLURGY: PROBLEM NOTES p 30–41 refs (See N70-28296 14-17)
6. OCEAN TECHNOLOGY: PROBLEM NOTES p 41 (See N70-28297 14-15)
7. RADAR: PROBLEM NOTES p 41–42 (See N70-28298 14-08)

N70-28348# Stanford Univ., Calif. Electronics Labs.
[PLASMA PHYSICS AND QUANTUM ELECTRONICS, RADIOSCIENCE, SOLID-STATE ELECTRONICS, AND INFORMATION AND DIGITAL SYSTEMS] Quarterly Status Report, 1 Oct.–31 Dec. 1969
1969 101 p refs
(Contract Nonr-225(83))
(AD-702066; SU-SEL-69-076; QSR-116) Avail: CFSTI CSCL 20/9

The status and results of research projects in the following general areas are summarized: Plasma physics and quantum electronics; Radioscience; Solid-state electronics; Information systems; and Digital systems. TAB

N70-28533# Advisory Group for Aerospace Research and Development, Paris (France).
AGARD BULLETIN: MEETINGS, PUBLICATIONS, MEMBERSHIP, JANUARY 1969
Jan. 1969 57 p refs
(AGARD-Bull-69-1) Avail: CFSTI

Outlines are given of panel meetings on aerospace medicine, electromagnetic wave propagation, flight mechanics, fluids dynamics, guidance and control, propulsion and energetics, and structure and materials. AGARD publications and members are listed. S.S.

N70-28591# Congress. Senate. Committee on Aeronautical and Space Sciences.
SPACE PROGRAM BENEFITS
Washington GPO 1970 383 p refs Hearing before the Comm. on Aeron. and Space Sci., 91st Congr., 2d Sess., 6 Apr. 1970
Avail: Comm. on Aeron. and Space Sci.

Testimony centered on the broad impact space is having, and will continue to have, on our society, our technology, our industrial economy, and our planetary environment. The direct benefits to science, to meteorology, to communications, and to management are discussed, along with the new processes whereby NASA is more effectively transferring technical information and getting it used throughout the socioeconomic system. Details are given on the NASA Technology Utilization Program and the distribution of scientific and technical publications; the impact of the space program on education; NASA's contributions to university research facilities; news media coverage and public interest in the space program; and NASA's reliability and quality assurance program. M.G.J.

N70-28671*# National Aeronautics and Space Administration, Washington, D.C.
RIGHTS IN DATA CLAUSES AND THEIR IMPACT ON INFORMATION FUNCTIONS OF GOVERNMENT
Garland T. Mc Coy 23 Mar. 1970 22 p Presented at 2nd Natl. Meeting of the Inform. Ind. Assoc.
(NASA-TM-X-62929) Avail: CFSTI CSCL 05B

Government policies regarding information acquisition and dissemination are discussed with emphasis on data rights problems relating to computer software. Rights in data policies governing NASA and DOD are summarized. Mention is given to AEC and HEW policy restrictions, acts for contractors protection, and data rights problems resulting from earh resource satellite operations. S.S.

N70-29013# Air Force Office of Scientific Research, Arlington, Va. Directorate of Information Sciences.
INFORMATION SCIENCES, 1968 Summary Report
Dec. 1969 94 p refs
(AD-702425; AFOSR-69-3000TR) Avail: CFSTI CSCL 5/2

A report is presented on the progress made on 65 contracts and grants active during all or part of calendar year 1968; in the four areas designated by the COSATI subject headings: documentation and information technology, language and linguistics, bionics, and information theory. Selected highlights of the program are given in the introductory chapter. This is followed by brief statements of progress and publications for each work unit. Indexes to institutions, principal investigators and ARPA supported efforts are included. Author (TAB)

N70-29045# Joint Publications Research Service, Washington, D.C.
TRANSLATIONS ON EASTERN EUROPE SCIENTIFIC AFFAIRS, NO. 106
25 Mar. 1970 20 p refs Transl. into ENGLISH from Eastern European publications
(JPRS-50149) Avail: CFSTI

CONTENTS:

1. DEVELOPMENT OF DERMATOLOGY IN BULGARIA TRACED Il. Petkov p 1-4
2. SCIENTIFIC COOPERATION WITH USSR DISCUSSED p 5–7
3. OUTSTANDING ENGINEERS RECEIVE MEDALS p 8–10
4. GDR REPRESENTATION IN INTERNATIONAL MEDICAL SOCIETIES p 11
5. DIRECTIONAL ANTENNA FOR RECEPTION OF 360 MHz SATELLITE SIGNALS J. Bator p 12–17 refs (See N70-29046 14-07)

N70-29067# Steinkohlen-Elektrizitaet AG, Essen (West Germany).
WATER-SUSPENDED COAL SUPPLY TO THERMAL POWER PLANTS [VERSORGUNG THERMISCHER KRAFTWERKE MIT STEINKOHLE/WASSER-SUSPENSION UEBER ROHRLEITUNGEN]
Heinrich Merten (Ph.D. Thesis—Tech. Hochschule, Darmstadt, West Ger.) Darmstadt, West Ger. Tech. Hochschule 4 Jul. 1969 110 p refs In GERMAN
Avail: CFSTI

Measurements were made of the frictional pressure losses

in four horizontal pipelines of different diameters, transporting coal/water suspensions in a wet grinding installation. It was concluded that deposit-free pipeline transport was only possible over longer periods in the turbulent flow range. Author (ESRO)

N70-29075# Bundesministerium fuer Wissenschaftliche Forschung, Bad Godesberg (West Germany).
SPACE PROGRAM OF THE GERMAN FEDERAL REPUBLIC, 1969–1973 [WELTRAUMPROGRAMM DER BUNDESREPUBLIK DEUTSCHLAND, 1969–1973]
[1970] 94 p In GERMAN
Avail: CFSTI

The German Federal Republic began its space research program in 1962 to prepare the German aerospace industry for major projects and in 1967 the Federal government began an intermediate advancement program with concrete scientific and technological projects. The space program for 1969 to 1973 was accepted by the Federal Cabinet in July 1969 and this report gives a detailed description of the targets for those years, along with the financial limits. ESRO

N70-29117# National Council for Research and Development, Tel Aviv (Israel). Center of Scientific and Technological Information.
DIRECTORY CURRENT RESEARCH IN ISRAEL Second Edition, 1969
Dec. 1969 691 p refs *Its* Guides to Sources of Inform. Ser., Directory No. 5
Copyright. Avail: Center of Sci. and Technol. Inform. $27.50

This second survey, updated to June 1969, covers 305 organizations and lists approximately 4,000 research projects on which 3429 scientists were engaged. The subject matter has been enlarged and includes, in addition to the subjects covered by the first survey, aeronautics, astronomy and astrophysics, and space technology. Some of the subject divisions have also been extended. In order to facilitate the use of the Directory the format of the publication has been enlarged while the arrangement has remained unchanged and the subject classification is still based on the COSATI Subject Category List of the U.S. Defense Documentation Center. Author

N70-29179# Iowa State Univ. Science and Technology, Ames.
CERAMIC AND MECHANICAL ENGINEERING, CHEMICAL ENGINEERING, CHEMISTRY, MATHEMATICS AND COMPUTER SCIENCE METALLURGY, PHYSICS, AND REACTOR DIVISIONS Annual Summary Report, 1 Jul. 1968–30 Jun. 1969
Jul. 1969 386 p refs
(Contract W-7405-eng-82)
(IS-2100) Avail: CFSTI

Progress is reported in the following areas: reactions and properties of metals in low oxidation states, use of bis(2-ethylhexyl) phosphate as a solvent for separating rare earths, preparation of metals and purification for fuel cladding, high to low energy physics, diffusion and structure of rare earth oxides, research and development project for the operation and utilization of the low power research reactor, and mathematics and programming research. J.M.C.

N70-29204*# National Aeronautics and Space Administration, Washington, D.C.
RESEARCH AND TECHNOLOGY OBJECTIVE AND PLAN SUMMARY: FISCAL YEAR 1970 RESEARCH AND TECHNOLOGY PROGRAM
[1970] 272 p
(NASA-TM-X-62953) Avail: CFSTI CSCL 05B

Technical summaries of the objectives of each program used for management review and control of research currently in progress are presented. The summaries are arranged in the following groups: power and electric propulsion; nuclear rocket propulsion; space vehicle systems; electronics systems; aeronautical vehicles; human factors systems; chemical propulsion; chemical rocket experimental engineering; physics, materials, and applied mathematics research; mission analysis; aerospace safety research; advanced manned space flight development; and tracking and data acquisition. N.E.N.

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NEW NASA PUBLICATION

Ecological Surveys from Space (NASA SP-230)

This monograph contains a sampling of color photographs, including infrared, that are being used to survey the earth's resources from space. Although intended mainly to call the attention of specialists—geographers, agricultural engineers, foresters, geologists, hydrologists, oceanographers, and cartographers—to the potentialities of ecological surveys from orbiting satellites, the publication may be of considerable interest to the nonspecialist because of the insight it provides into the techniques of interpreting photos for earth resources evaluation.

Lines, patterns, and colors in aerial and space photos reveal what both nature and man have done to the face of the earth. Land uses traceable to cultural and societal developments usually contrast sharply with phenomena resulting from the natural or physical base. Restricted by his environment, man has been forced either to adapt himself to the land or to modify it with machinery and structures. In photos taken from high altitudes, highways appear as networks of fine lines, agricultural fields produce recognizable patterns, and the areas from which forests have been cleared stand out brightly. Colors are indicative of the vegetation, soil conditions, the depth of water, and many other matters of vital concern to mankind. *Paperbound.* 80 pp. Price $1.75. Available from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

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